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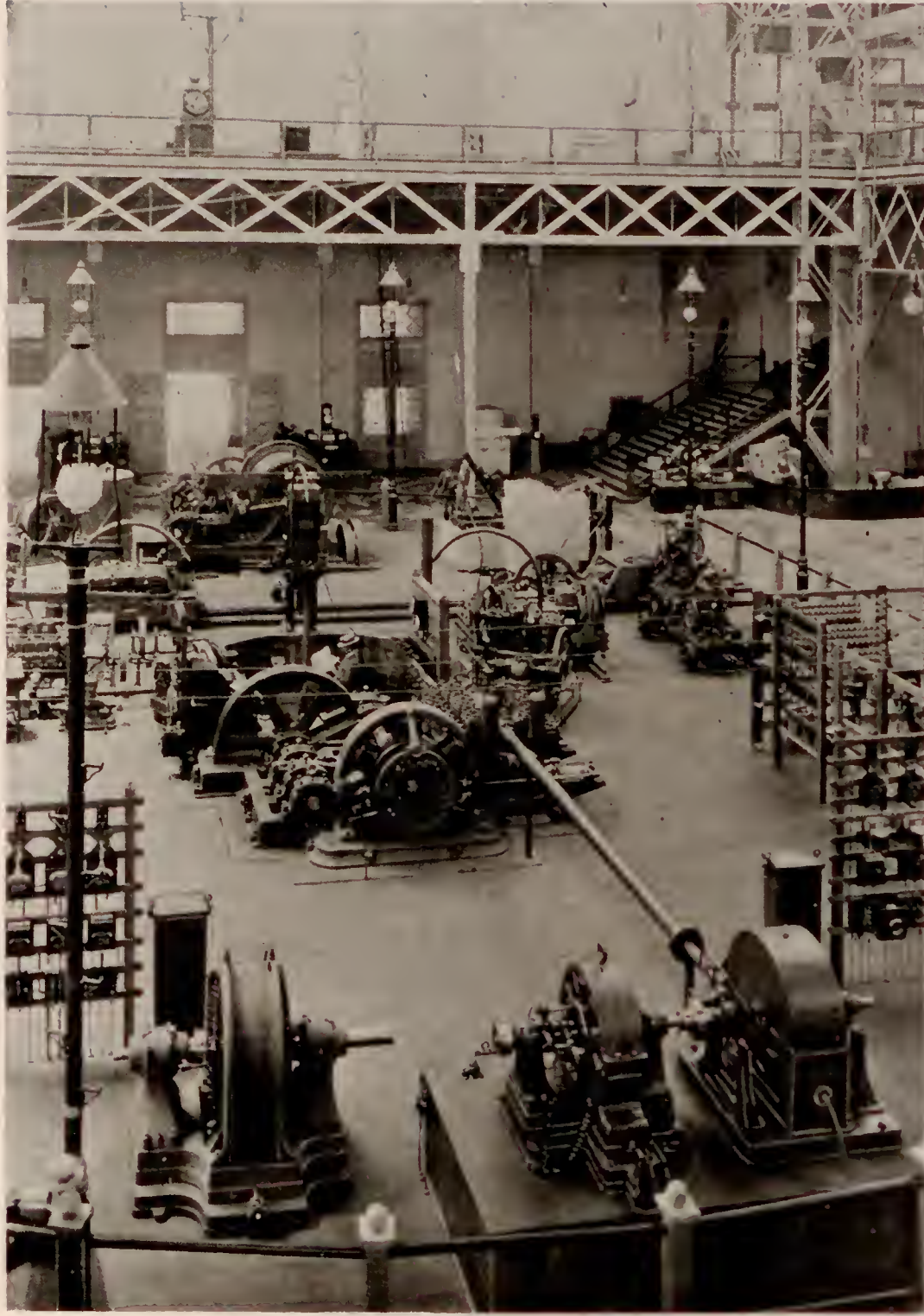
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VIEW IN ELECTRICITY HALL

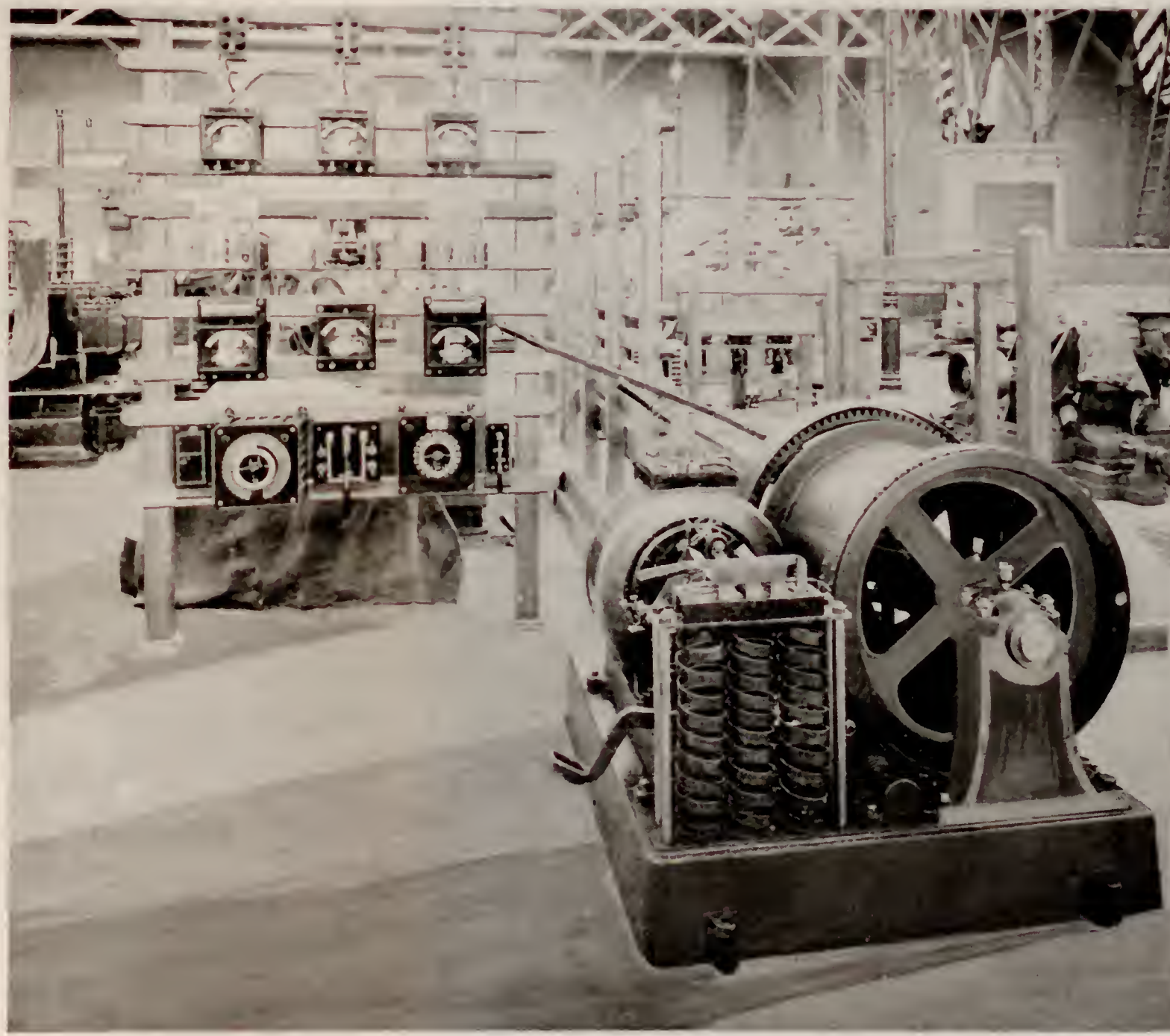
"An effective piece of lighting appears in the Fisheries building. The large circular pavilion upon the east is used as an aquarium. Around the building are arranged continuous concentric rows of great tanks. The sides of these tanks are of clear glass, and are continued in the ceiling by stained glass screens, so that the observer walks in a covered corridor the sides of which are of glass, and through which can be seen the representatives of all the finny tribes disporting themselves in their native element. No lights are visible; but the tanks are lighted by hundreds of incandescent lamps placed under screens above the tanks, so that the light does not strike the eye, but is diffused throughout the water, which is illumined as effectively as at noonday."

In the illuminated city of the Fair the attraction is not in the myriads of arc and incandescent lamps, with their elaborate settings, nor in the circular electroliers, some of them suspended, as in the hall of Manufactures, 150 feet above ground. Rather is it the part that each one plays in the general effect, the special feature that its light accentuates, all contributing to give to this wondrous display the aspect of a veritable fairyland, to raise it, for the moment, almost beyond the realm of matter.

Let us imagine ourselves standing at eventide in the central court, now almost a solitude, haunted by the shadows of deserted temples cast athwart the plaza. Toward the east darkness is settling over the waters of the lake. Northward and to the west a heavy pall of smoke broods over the great midcontinent metropolis, and far to the south the lurid flames of a blast furnace

are faintly visible on the dusky horizon. Suddenly a beam of light shoots like a falling star from the lofty dome of the Administration building, and a moment later its symmetrical outlines stand out in tracery of fire. At its base is a circling wheel of light, and a hundred torches further relieve the black abyss beyond. Meanwhile a thousand lamps, clustered around the central avenue, have turned the night into day. Thus also the other great buildings that encircle the court assume their robes of light, with pillars, porticos, and colonnades blending in weird, yet brilliant perspective, like the threshold of an enchanted palace.

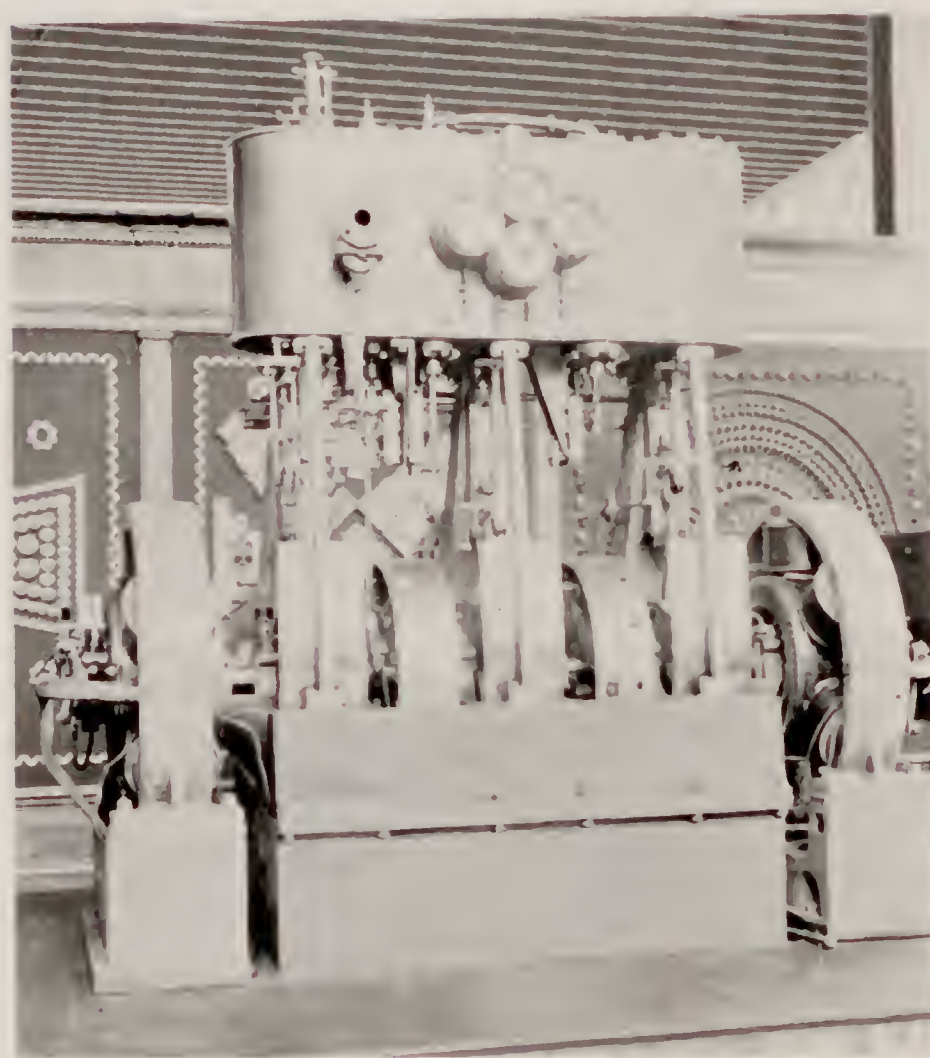
From the summit of the Manufactures building a pyramid of dazzling light is cast on the dome of the Administration building, throwing into strong relief its delicate tracery of gold and white. Then in swiftly changing streams of white, green, and blue, purple,



GROUP OF EDISON MACHINES

yellow and scarlet, three search-lights are turned simultaneously on the central court, the basin, the MacMonnies fountain, and the statuary here displayed in lavish profusion. In the heroic statue of the republic, with its background of double columns shining like pillars of Carrara marble, every inch of its golden surface glitters beneath the piercing rays. Presently the search-lights sweep the horizon, one of them resting for a moment on the graceful figure of Diana, poised against the sky as though suspended in mid air. Another is turned toward the lake, casting its bright sheen on the waters of Michigan, and striking the sails of a passing vessel, whose white wings slowly vanish from sight. Gradually the scene grows warmer in its wealth of coloring, and the lights and shades more intense in contrast, the copses and groves of wooded island, with its garb of verdure, throwing their shadows across the tracery of fire.

But the climax of all this brilliant display is in the electric fountains at the head of the lagoon in front of the Administration building. Here are light effects of surpassing loveliness, in rich varying hues, sprays, jets, and columns of water appearing as though ablaze in the glow of these powerful electric currents.



MULTIPLE GENERATOR

Between them is the MacMonnies fountain, its waters iridescent as the rainbow, the centre-piece with its group of figures resembling a phantom ship with phantom crew, beautiful but with an unearthly beauty. Under these changing colors the vessel seems to float, now on a sea of white, and again on a rose-colored expanse, on frosted silver or on molten gold. Near by gondolas and electric launches speed swiftly to and fro across the lagoon, breaking its resplendent surface into a thousand glittering fragments, while from the plaza strains of music are wafted into the still night air, and above all is heard the ceaseless murmur of the waves, breaking on the shore adjacent, as with the low sad monotone of ocean.

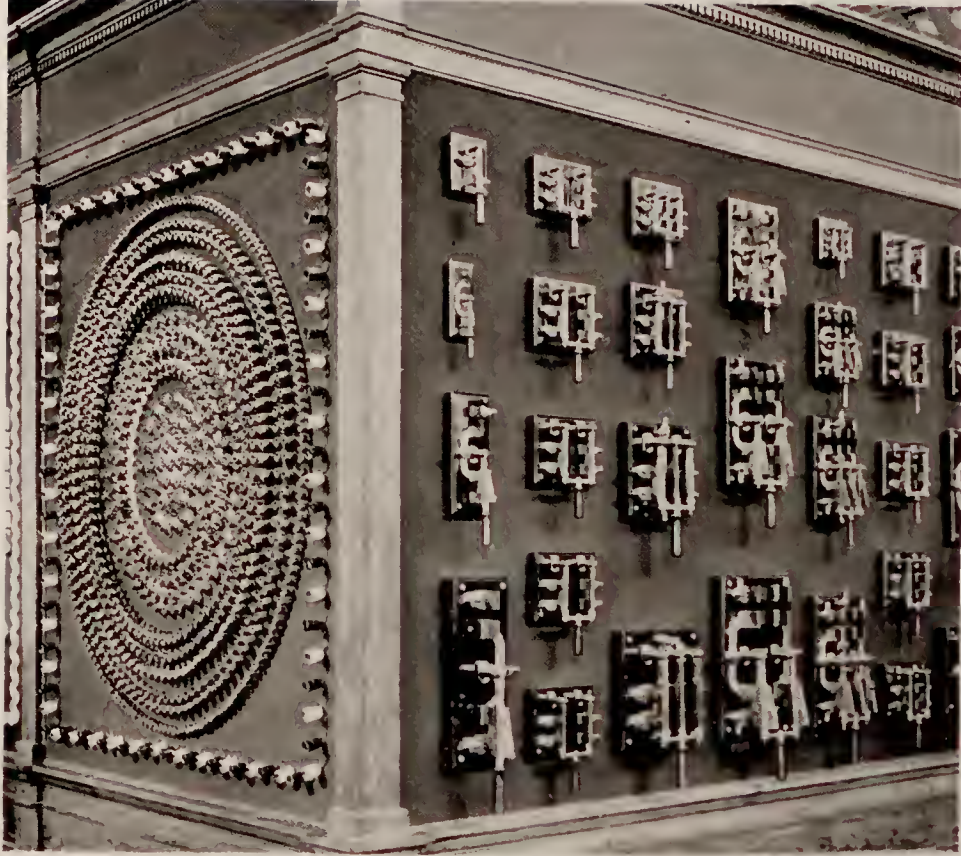
Such is the entertainment offered by night at the Fair, but on no two nights alike, presenting a new combination of brilliant effects at each illumination, and varied at times with fire-works, the latter, as it would appear, somewhat out of place amid this marvellous scenic display, and more than once threatening serious disaster to the Exposition buildings and their rich contents. No wonder that these artistic glories of the night, surpassing even the spectacular marvels of the day, brought visitors to the grounds by scores of thousands, and to the management a goodly increase of revenue. Under the glow of myriads of lamps the architectural symmetry of the design is displayed to excellent advantage, the uniform cornice level of the buildings, sixty feet above ground, standing clearly forth in tracery of incandescent lights, while encircling the basin near its water level an unbroken circle of vari-colored jets, each reflected from its glittering surface, gives to the scene a brilliance almost too dazzling for human eye to rest upon.

From this brief description of the Fair by night let us turn to the exhibits proper of the department of Electricity, for here also are many attractions for every class of visitors. While some portions of the Exposition are largely occupied with technical collections, such as are of special interest only to those with whose business or studies they are connected, here is one that represents the greatest and yet the youngest and most progressive of the sciences, one whose marvels, though surpassing the wonders of dreamland, are presently to be excelled by others yet in store.

Passing from the railway station along the northern side of the central court, the visitor will observe in the spacious portico of a building on his left, a colossal statue mounted on



WIRING APPARATUS



INCANDESCENT APPARATUS

describing this gem of artistic workmanship, with the façade to which it gives emphasis, I cannot do better than adopt the words of one of its artificers, Henry Van Brunt, of the Kansas City firm of Van Brunt and Howe, to whom I am partially indebted for my sketch of other Exposition buildings.

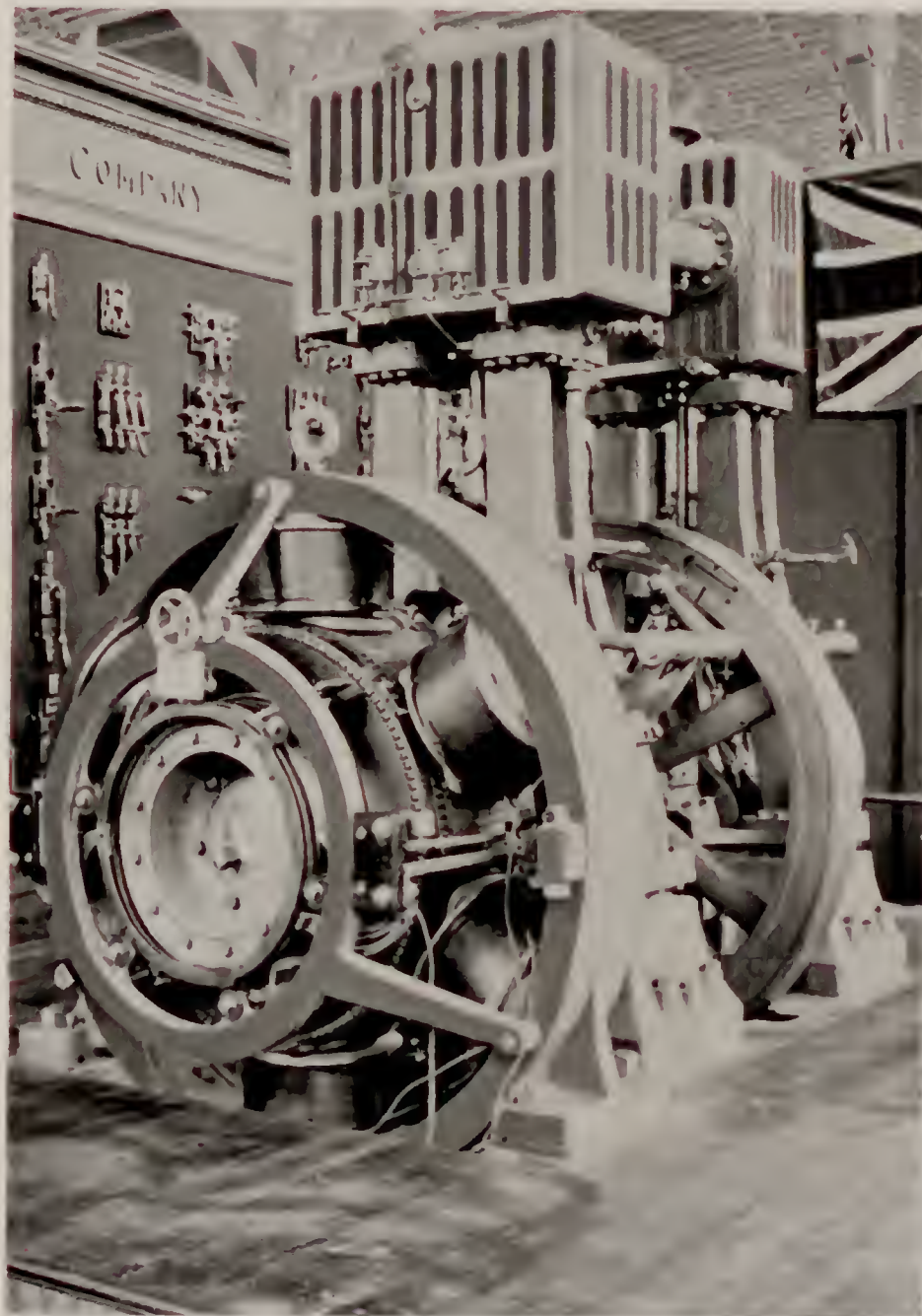
"On the south side," he says, "it was necessary to make a concession to that spirit of grandeur and ceremony which should prevail around the great court of the Exposition. Accordingly the vertical line, predominant elsewhere in the building as a foil to its long, low, horizontal mass, is here subordinate to the spirit of repose. To this end the campaniles on the corners are set back from the front, but connected with it by gabled pavilions, and the principal entrance on this side is treated as a triumphal arch, crowned with a classic pediment containing an escutcheon, which bears the electromagnet as a symbol of electricity, and is supported on each side by a female figure representing the two principal industries connected with this science—electric lighting and the telegraph. Above, in contrast with the somewhat fantastic movement of the skylines elsewhere, rises a solid elevated attic, forming a

a pedestal, and on the frieze above it the following inscription:

Eripuit Cælo Fulmen Sceptrumque Tyrannis.

In the statue he will recognize that of the great philosopher who, if he did not, as the epitaph would have us believe, wrest from the tyrant his sceptre, was the first to steal from heaven its lightning. Passing through the portal and beneath the arch which encircles it, we find ourselves in the hall of Electricity, an edifice somewhat daring in design, but with such elements of the picturesque as its special uses would permit. Before making further mention of this structure, let us pause for a moment within its portico, for here is one of the main architectural features of the composition.

In des-



EDISON DYNAMO



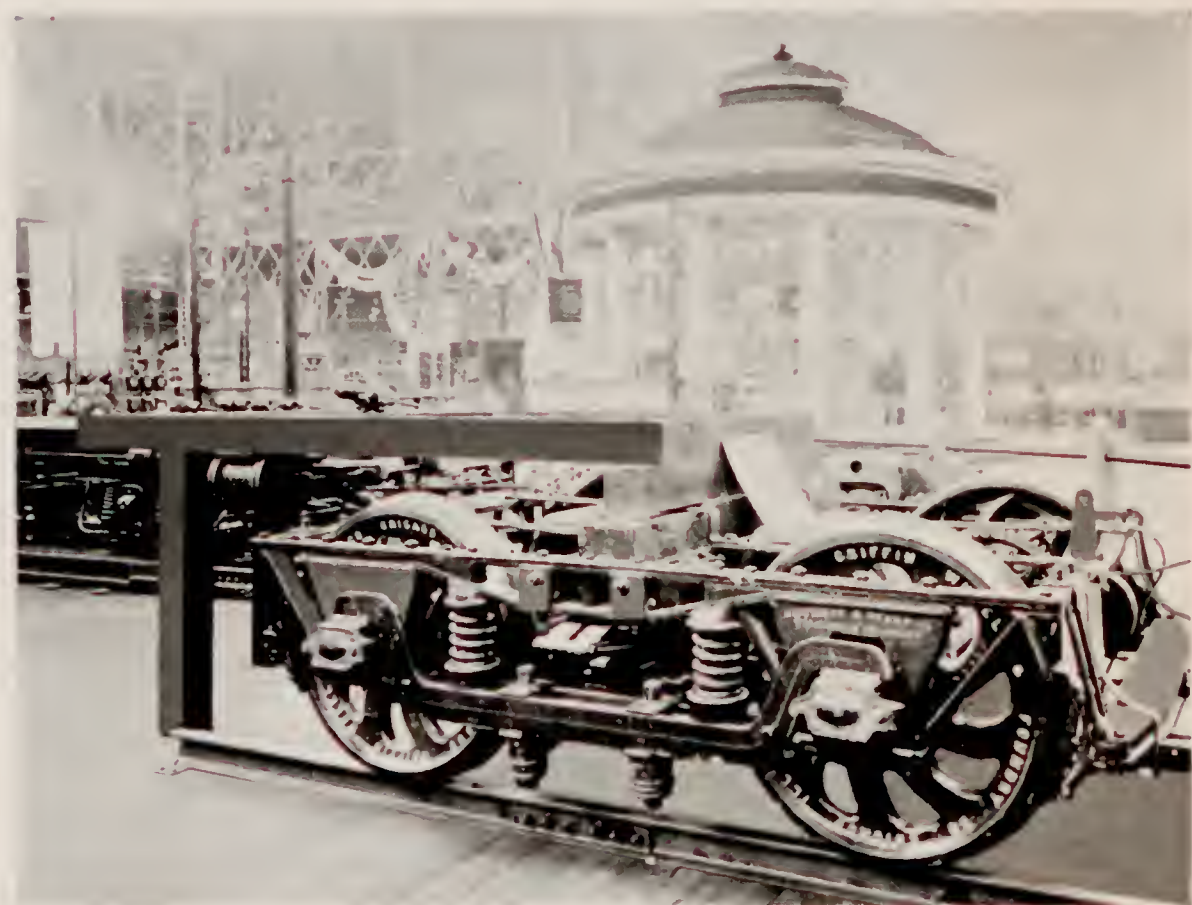
ELECTRIC ELEVATOR

severe horizontal outline against the sky. This central mass is buttressed on each side by great consoles, supporting emblematic statues resting on pedestals, and embellished with medallions of Morse and Vail, the American inventors of the electric telegraph."

In the centre of the great portal is the statue of Franklin, by Carl Rohl-Smith, fifteen feet in height, and one of the best conceptions ever presented of the great discoverer, his gaze turned upward toward the lowering clouds, in one hand the kite, and in the other the key of which all the world has read. Upon the frieze are inscribed in alphabetical order around the building the names of more than threescore electricians of all nationalities,

whose names have become historic, the fame of those who are still among the living resting upon the exhibits within.

In preparing the plan of the Electricity building a space of twenty-three feet was adopted as the unit of measurement, fifteen of these modules forming the interior width of the building, and five that of the longitudinal nave which forms its central feature, the latter intersected by a transept of equal width and height. On each side of the nave are aisles, one module in width, and above is a series of galleries connected by bridges, and to which access is afforded by spacious stairways on either side of the principal entrances. To



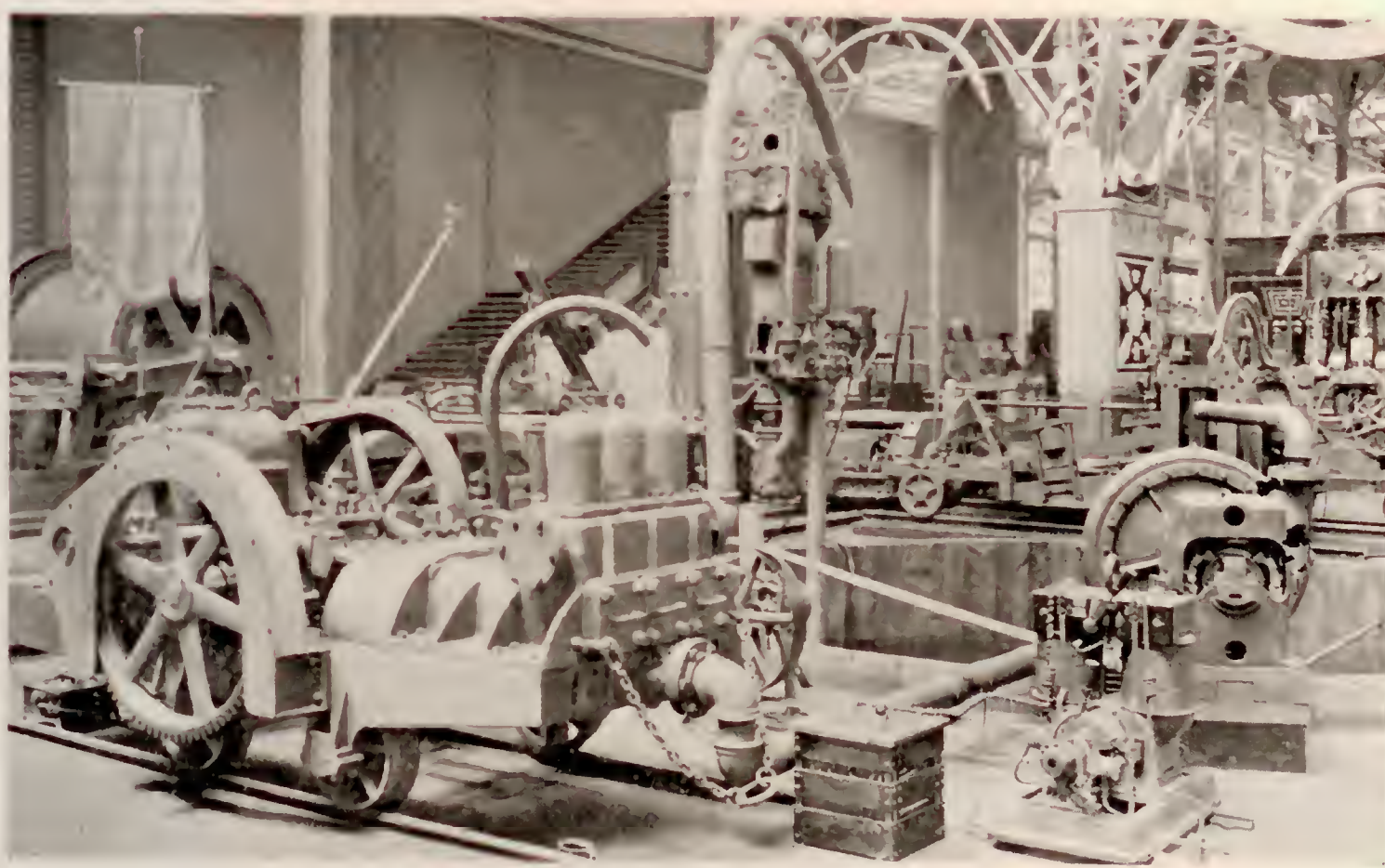
EDISON STREET CAR MOTOR

provide for the central areas occupied by nave and transept, both are unencumbered with columns, their pitched roofs being supported by arched trusses of sufficient height to admit of clear-story windows, and with a range of skylights at the foot of the pitch. Flat roofs with skylights cover the remainder of the building.

The area of Electricity hall, apart from galleries, is little more than five acres, fronting on the main court 350 feet, and extending about twice that distance length-wise toward the lagoon. Hence in this structure, small by comparison with its neighbors, but only by comparison, it was a part of the design to give to it such features as should mask its inferiority of size. But this could not be secured by giving additional height to the curtain walls, which must not exceed sixty feet from ground to cornice. The bays were therefore fashioned so as to furnish at frequent

intervals bases for towers, and between them pilasters of the Corinthian order, projecting boldly from the piers, and ending in pedestals supporting banner-staves, which served also for a continuous series of electric lights. Further to emphasize the vertical lines of the building, in the centre of its two longer façades the intercepting transept ends in a pavilion, flanked with towers, upon which rests an open belvedere with rounded attic, supporting a cupola, and ending in candelabra of electric lights reflected from the overhanging canopy nearly 200 feet above ground. In front of the pavilions are porticos, with columns more than forty feet high, and also of the Corinthian order. On the north side, where the proximity of the lagoon permits more freedom of style, the portal is placed midway between two semi-circular projections, the towers on either side resembling those of the east and west pavilions, while on the panels of the arch are recumbent figures typical of discovery and investigation. Elsewhere the decorative scheme suggests the purposes to which the building is devoted, helping with the tall campaniles and their intermediate domes, to relieve a too strict conformity to classic models.

While the main object of the Electrical department, contained for the first time in a building of its own, is to display, with competitive tests, the working of electrical apparatus in practical use, it is also intended to present a history of this science from its very inception, with models, and in some instances



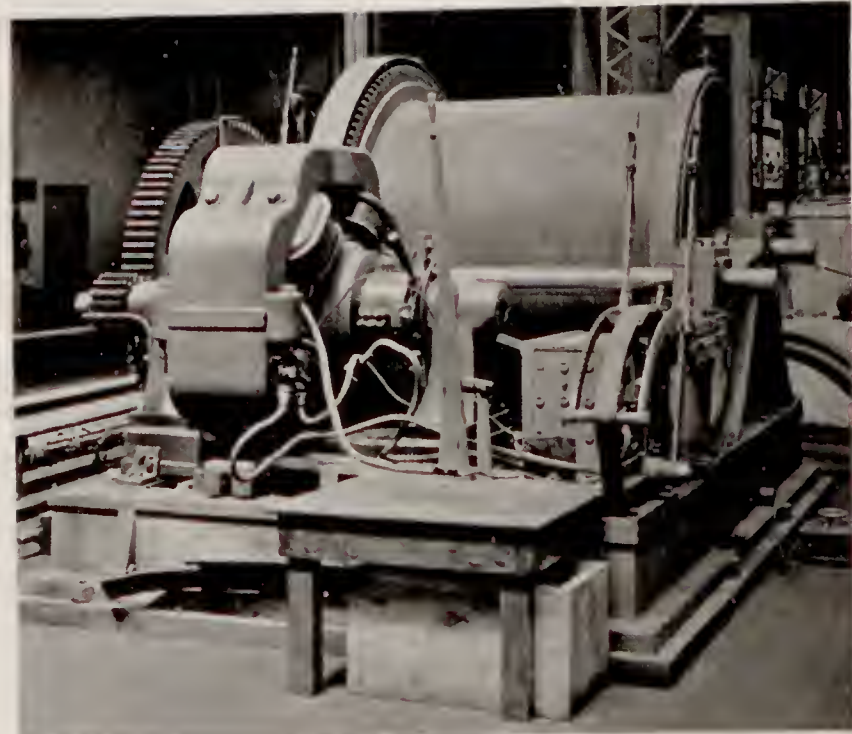
MINING PUMP

the actual appliances used by the earlier inventors. Of the plant located in Machinery hall mention has already been made, and in addition to lighting its power is applied to manifold purposes, among them for the operation of an elevated railway within the grounds, for mining, milling, and metal work, for exhibits of electricity used for artistic effect, and in a word for all the wide field in which electric science has gained a permanent foothold.

Says the chief of the department: "The general scheme to be carried out is twofold. The exhibits will be practical, and they will also be popular. Every electrical concern and enterprise of any importance in



THE FRANKLIN STATUE

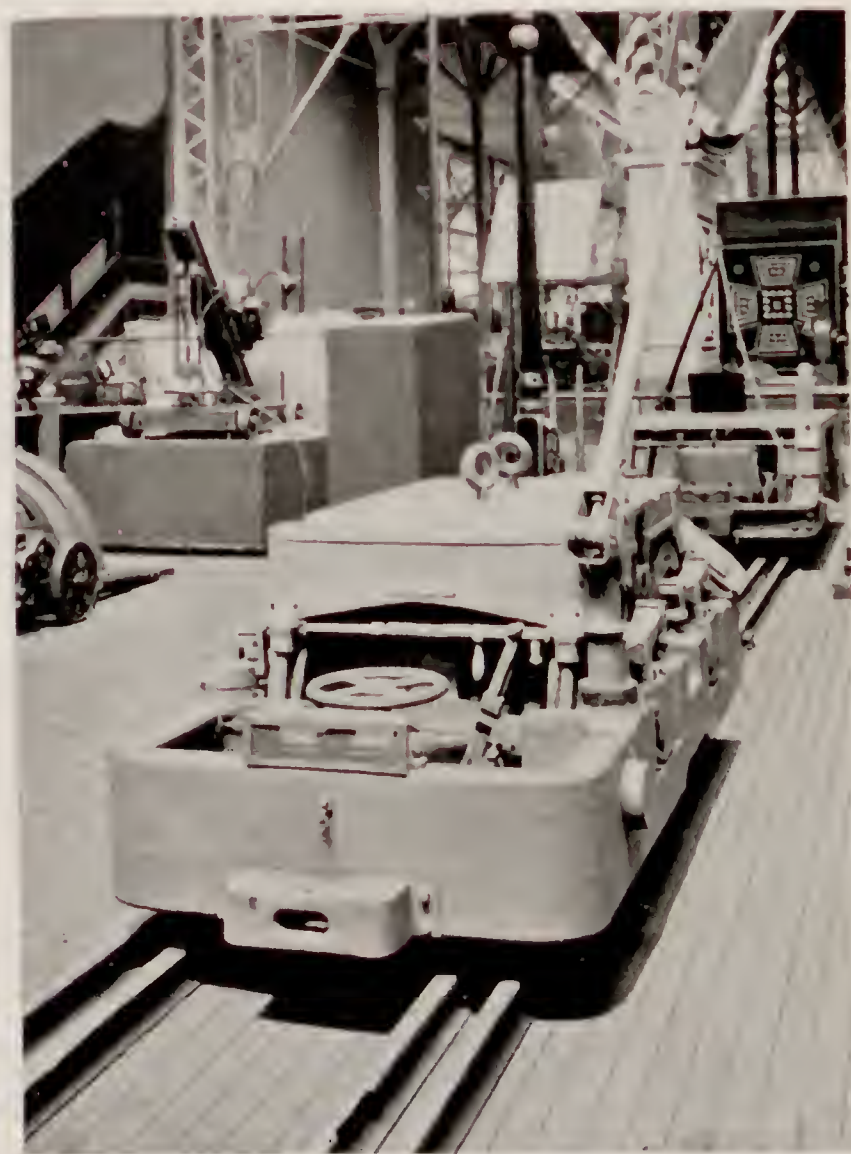


MINING HOIST

The final object is the enlightenment of the people as to the progress of a branch of science and industry yet scarcely out of its cradle, and to foreshadow the possibilities of its future."

In the centre of the building, and forming a part of the exhibits of the General Electric company, is the Edison tower, the so-called tower of light, its shaft encircled by thousands of miniature lamps, arranged in unique design, and with kaleidoscopic effect. Above it is a large incandescent lamp or series of lamps, composed of innumerable pieces of crystal, and at its base a pavilion, surrounded by a circular peristyle, and containing a number of electroliers and globes exhibited by a Pittsburg company, these also illumined at night by electricity. Thus when, at the silent touch of an unseen hand, the tower from base to apex is arrayed in robes of scintillating and many colored lights, we have here the very incarnation of electric science.

In the company's display are illustrated nearly all the uses to which electricity is put, their collection including machinery and apparatus of every description from the smallest of lamps to the most powerful of dynamos, and from electric toys to motors and motor cars. West of the tower of light is a section containing 2,500 specimens of Edison incandescent lamps, such as are made at the company's works at Harrison, New Jersey, and as declared by the highest courts of justice in Europe and the United States, the only lamps that are lawfully manufactured. Lamps are also shown in different stages of construction, illus-



THOMSON HOUSTON MINING LOCOMOTIVE

the world will be represented. By means of the practical arrangement of the exhibits, by means of their scientific classification, covering the entire field of electrical science, by the opportunities afforded to compare the results of the more prominent electrical systems in supplying electric service for light, power, heat, and commercial purposes, with each of these different systems in actual operation, side by side, and almost under identical conditions, great popular object lessons will be presented, which will not only be intensely interesting to the eye and sense, but will also be highly educational to the electrical engineer, the central station manager, the manufacturer, the student, and the public in general.



ELIHU THOMSON

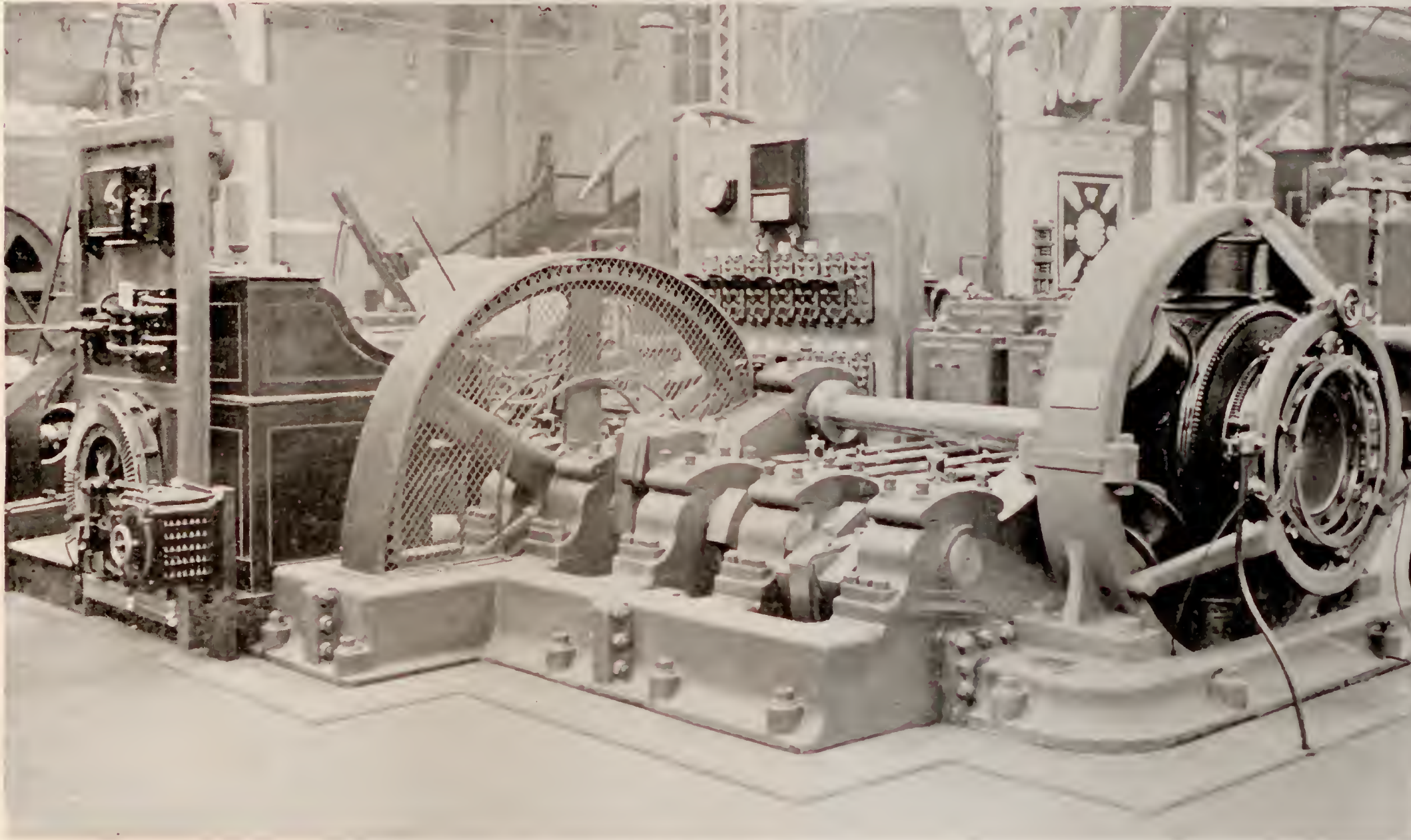


DRILLING BY ELECTRICITY

trating the experiments of the inventor from their first inception to the perfected mechanism of the present day. In one of the compartments is apparatus for decorative purposes, so arranged that the quantity of light consumed can be regulated and registered by meters. In this section also is the first dynamo for incandescent lighting constructed by Edison in 1880 at his works at Menlo park, and near it is one of the dynamos used, some ten years ago, at a New York station of the Edison Electric Illuminating company. Though both are now somewhat out of date, they were regarded at the time as among the marvels of the age. The isolated incandescent lighting systems, such as are adapted to the use of hotels, theatres, and large business buildings are shown in a separate group.

In its eastern section the company displays its Thomson-Houston arc-lighting apparatus in a larger oaken pavilion, containing also carbons of various grades arrayed in geometric figures, with dynamos and other appliances. Elsewhere in this section are the experimental apparatus used by Elihu Thomson for high voltage discharge, with portions of trees that have been struck by lightning showing the path of the bolt.

Among the objects of the department of Electricity was to illustrate the possibilities of that science as applied to mining and milling ores, not only in the transmission of power but in its direct application to purposes for which it could be made available. All this is demonstrated in the company's exhibit of machinery and appliances, including engines for hauling rock, mining pumps, hoists, drills, dumps, pressure



ELECTRIC MOTOR AND PUMP

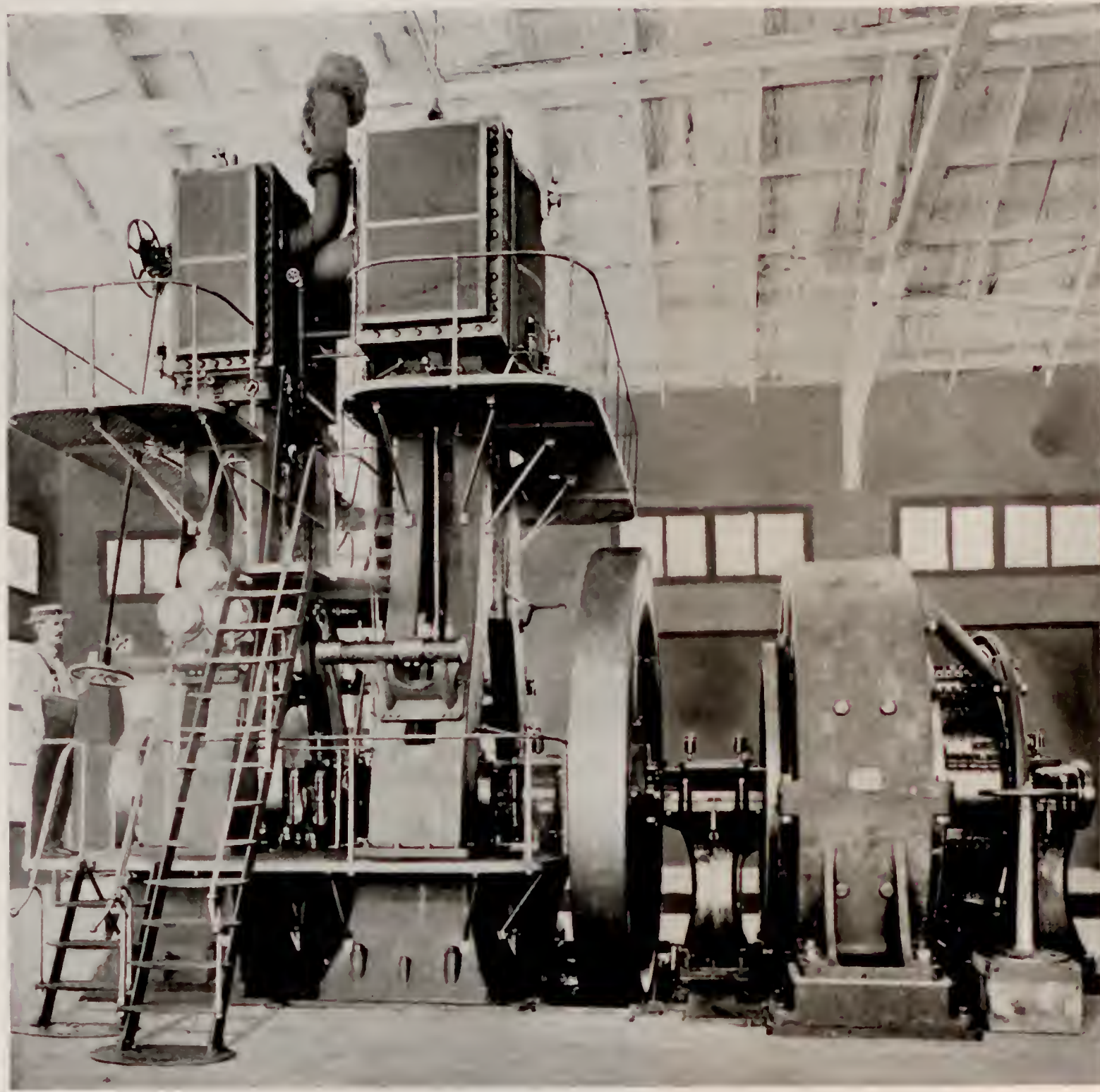
blowers, air compressors, and centrifugal fans, with blocks of stone to show the working of the drills, and a large water tank to display the operations of the pumps. Thus is scientific mining being gradually revolutionized through the use of electric apparatus, which is also largely availed of for the working and refining of metals. Such machinery is rapidly gaining in favor throughout the mineral regions of the continent, from the coal mines of Pennsylvania to the gold and silver mines of Colorado, California, and Mexico. In addition to their more economic and expeditious work, electric appliances can be used to advantage at all seasons of the year, for the current in the wires is never checked by frost, and suffers no loss from condensation.

Southwest of the Edison tower is the company's office, and adjacent to this its display of electric motors for railway purposes, for power transmission, and for general application, with a specimen of such as are used in the electric launches which ply on the waterways of the lake. There are also derricks, hoists, and a large collection of railway apparatus, with photographs displaying among other objects of interest the first electric railway built, as I have said, in 1885. Elsewhere in the company's collection are



A GROUP OF MOTORS

magnets, induction coils, converters, and transformers; instruments of precision, voltmeters, ammeters, and Watt meters; dynamos with direct and alternating currents, and for duplex telegraphic service, and apparatus used for war vessels, and for electrical construction and repair.



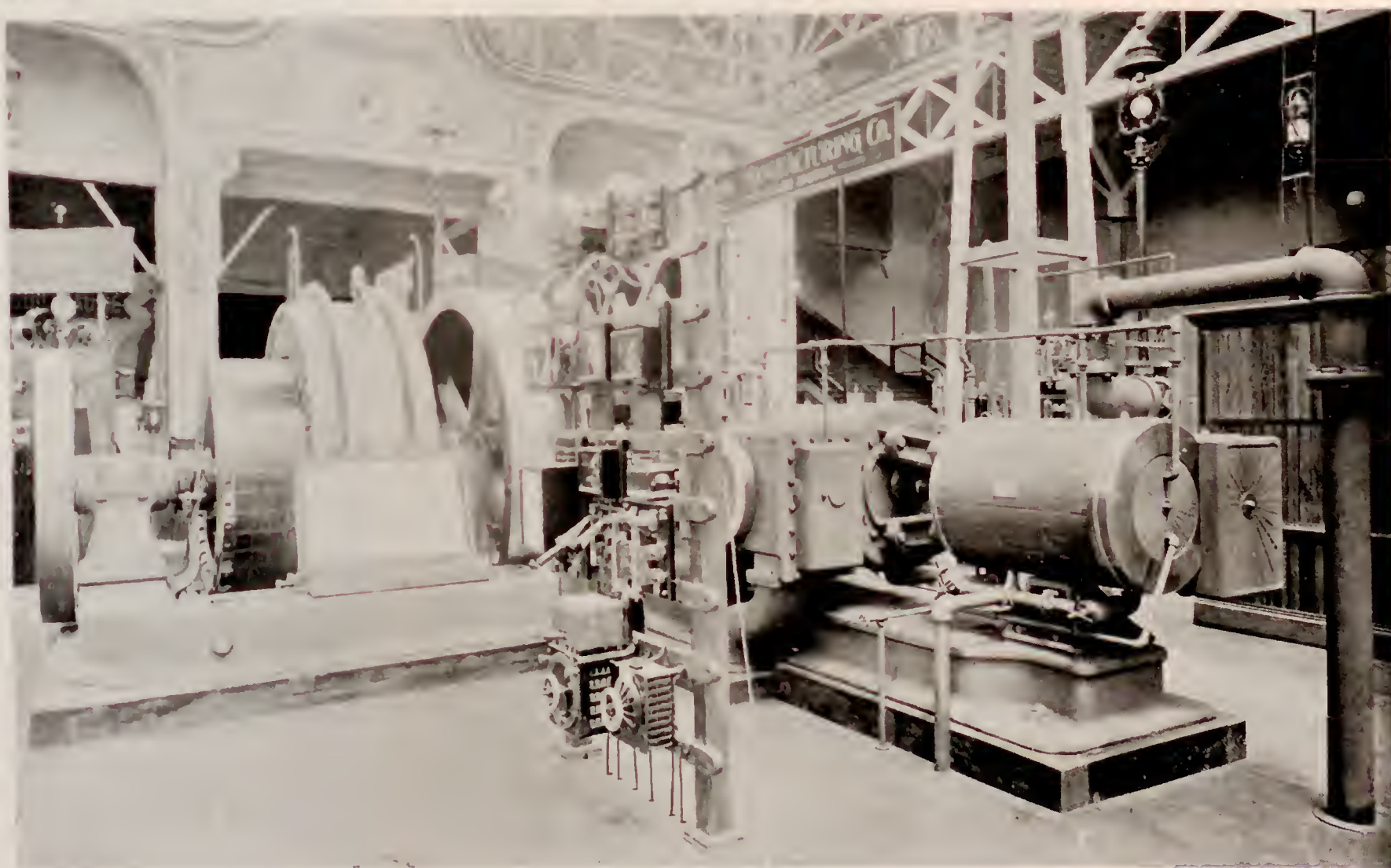
DYNAMO AND ENGINE

Upon the tracks west of the terminal station the company has on exhibition what is claimed to be the most powerful electric locomotive in the world. It weighs thirty tons, is more than sixteen feet long and eleven in height, and has two motors, one at each axle, supplying the power. The locomotive is substantially constructed, its cab being of sheet iron with a fine interior finish of hard wood. Although the engine has been especially devised for railway work, it is proposed to introduce it upon suburban and elevated roads, and upon switching and short freight lines. An electrical air compressor furnishes power for brakes and whistles.

In truth there are few exhibitors more fully represented in the various branches of the Fair. By this company was furnished the equipment for the elevated intramural railroad, with power sufficient to keep in motion on its road-bed eighteen trains at a time, and with accommodation for several thousand passengers. The elec-

tric launches on the lagoons are propelled, as I have said, by its motors, the power being furnished by storage batteries beneath the deck. The huge iron girders and trusses in the Manufactures and other buildings, the monster locomotives in Transportation hall, and the heavier groups of statuary were all placed in position by its motors, which are also largely used for supplying machinery with motive force. Finally the electric fountains and two of the search-lights used for illuminating purposes came from the company's workshops.

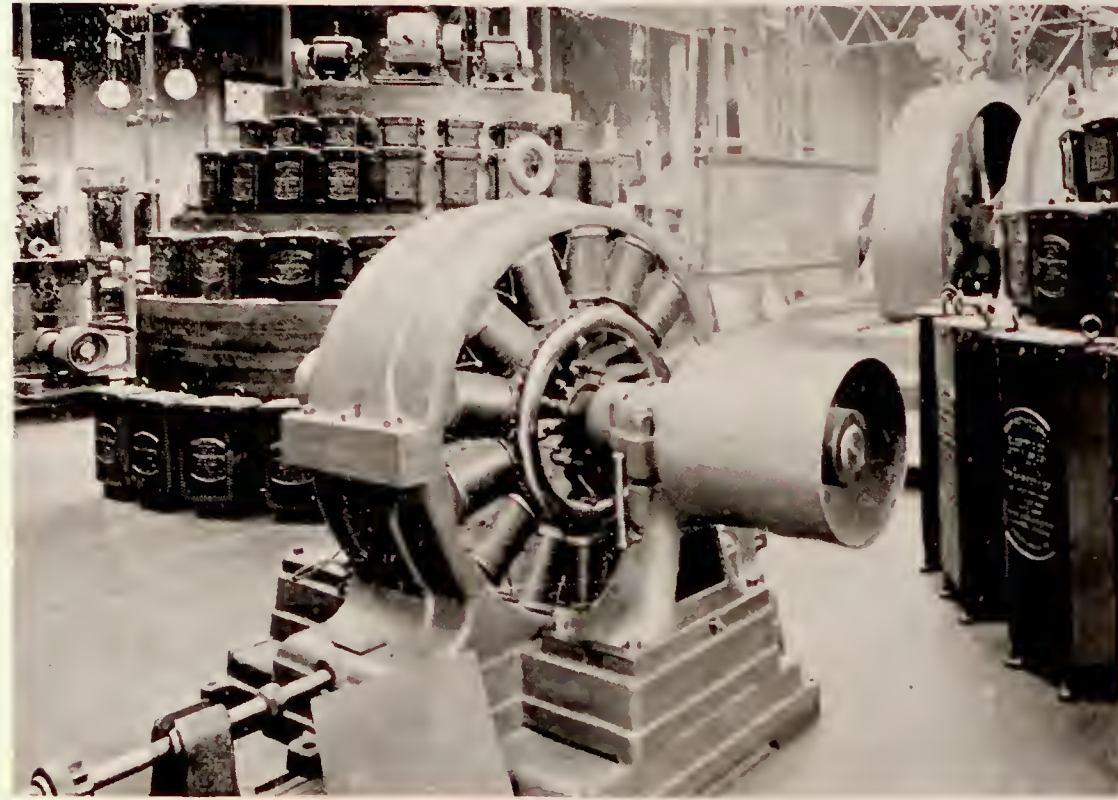
Adjacent to the exhibits of the General Electric company are those of the Westinghouse Electric and Manufacturing company, by which was installed in Machinery hall the great power plant used for lighting the Exposition and buildings, capable of supplying simultaneously nearly 200,000 lamps with a total capacity of more than 3,000,000 candle-power. In the collection of appliances for arc and incandescent lighting, prominence is given to its alternating current lighting apparatus; but here and elsewhere are fully illustrated all the more recent improvements in the various branches of applied electricity. An interesting feature in its display is



ALTERNATING DYNAMOS

a profile of Columbus, with decorative scrolls and letters, traced in incandescent lamps against a background of terra cotta on the southern wall of the Electricity building.

Elsewhere in its 15,000 feet of floor space, and north of the Edison tower, is a darkened room for the



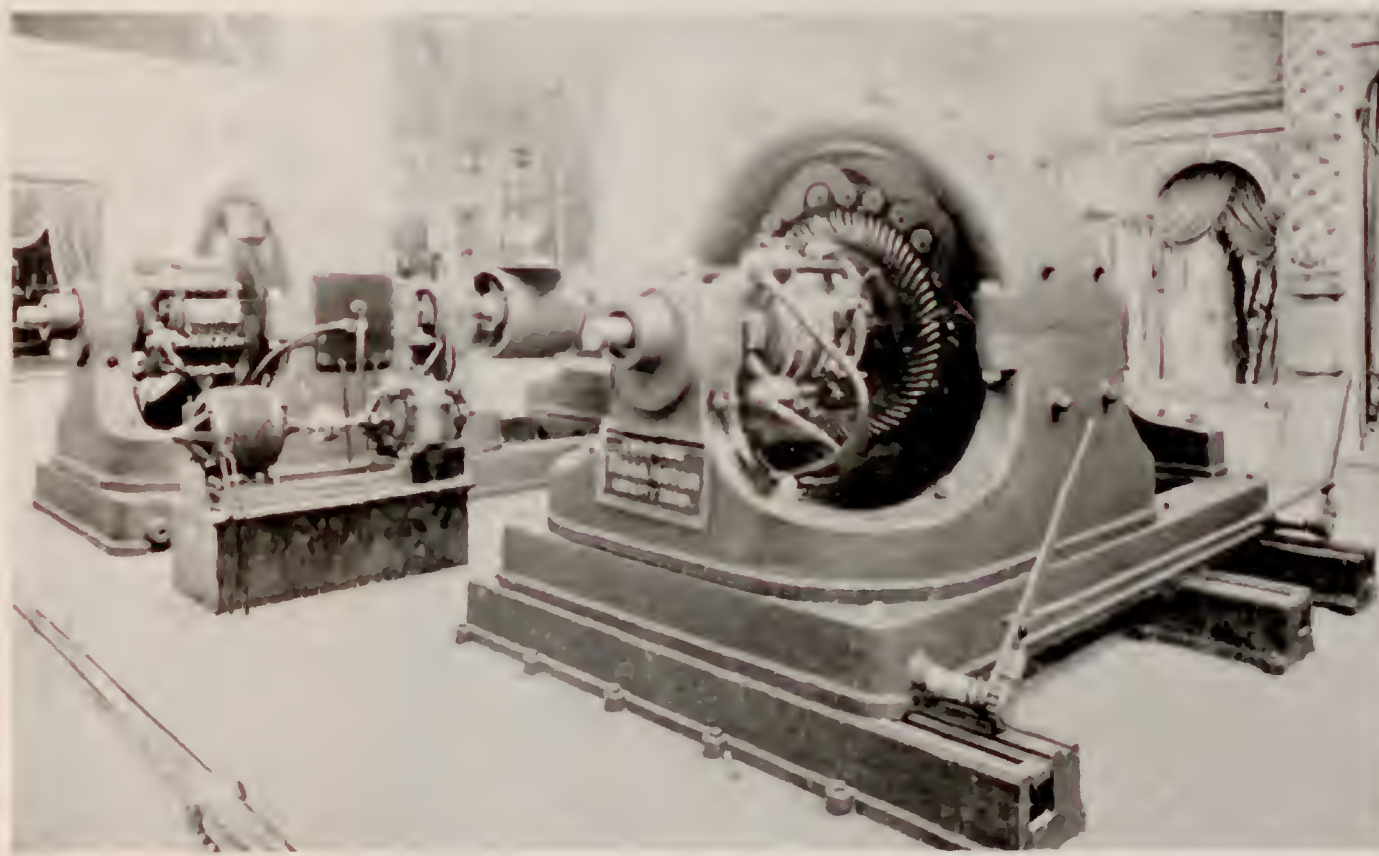
A MAMMOTH DYNAMO

display of what are termed high potential and high frequency phenomena. Adjacent to this we enter, through an archway richly colored in cream and gold, a section containing several of the first motors fashioned by the Austrian inventor, Nikola Tesla, with apparatus showing the results obtained in the use of high frequency alternating currents. Here also is fully illustrated the Tesla polyphase alternating current system for the transmission of power, including a 500 horse-power generator, the switch board at the generating station being connected with the one at the receiving or distributing station by an overhead four-wire circuit. The insulators that support this circuit are of the pattern designed for the San Antonio Light and Power company of Pomona, California, by which power up to 10,000 volts can be transmitted for 28 miles by an overhead circuit of bare copper wire.

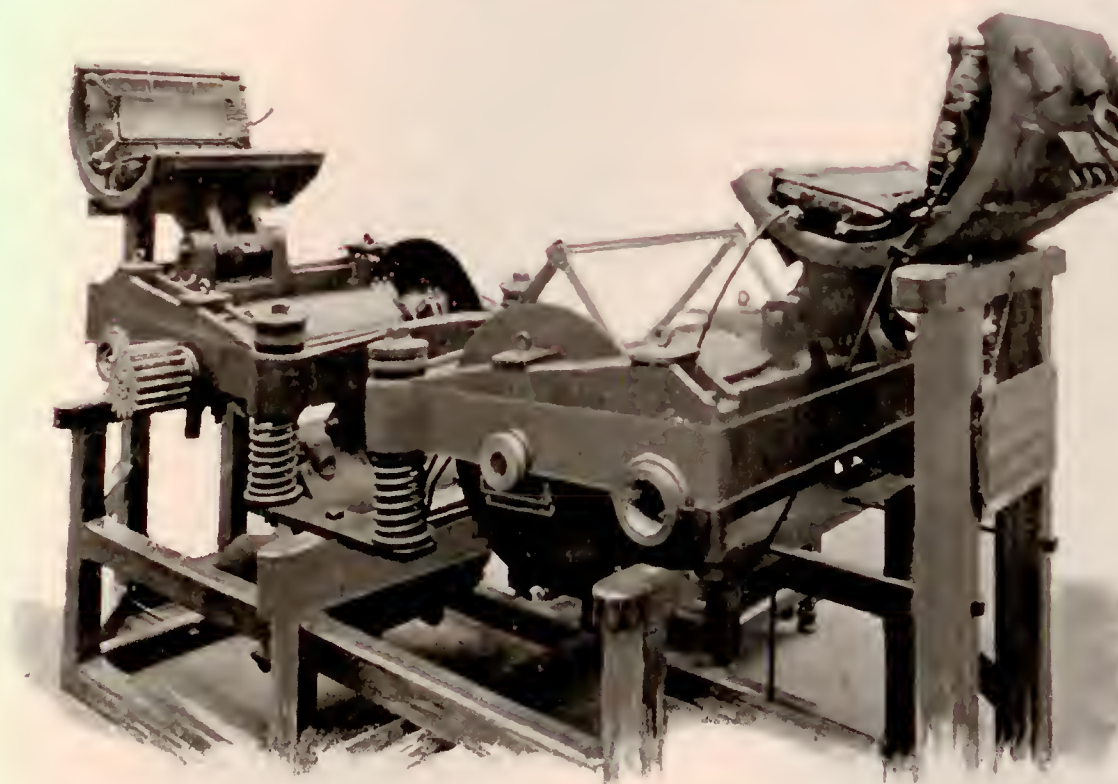
In its southern section the company has a

collection of street railroad apparatus, with two powerful multipolar generators, one driven by a compound engine, and the other by a belt, with cars equipped with motors of the single reduction type, beneath which are galleries permitting visitors to examine their interior mechanism. There are also lines of switches, ammeters, voltmeters, and circuit breakers, with minor exhibits pertaining to the construction and working of such electric railway systems as those in which the company's cars carry their thousands daily between Chicago and its Fair.

A large area in the southeastern portion of the hall is occupied by the Western Electric company, of Chicago, whose exhibits consist of the apparatus which it manufactures, and the various spectacular effects produced thereby. The column which flashes forth zigzag lightning, around it revolving balls of fire, is one of the ornamental gems of the Exposition, and divides attention with the Egyptian temple whose exterior walls are decorated with native figures engaged in the manufacture and operation of the telephone, fire alarm, electric apparatus, and other of the company's devices. Egyptians



are manipulating cables, dipping reels of wire into insulating baths, and bearing to their queen, typical of Chicago, lamps, dynamos, motors, batteries, and other appliances.

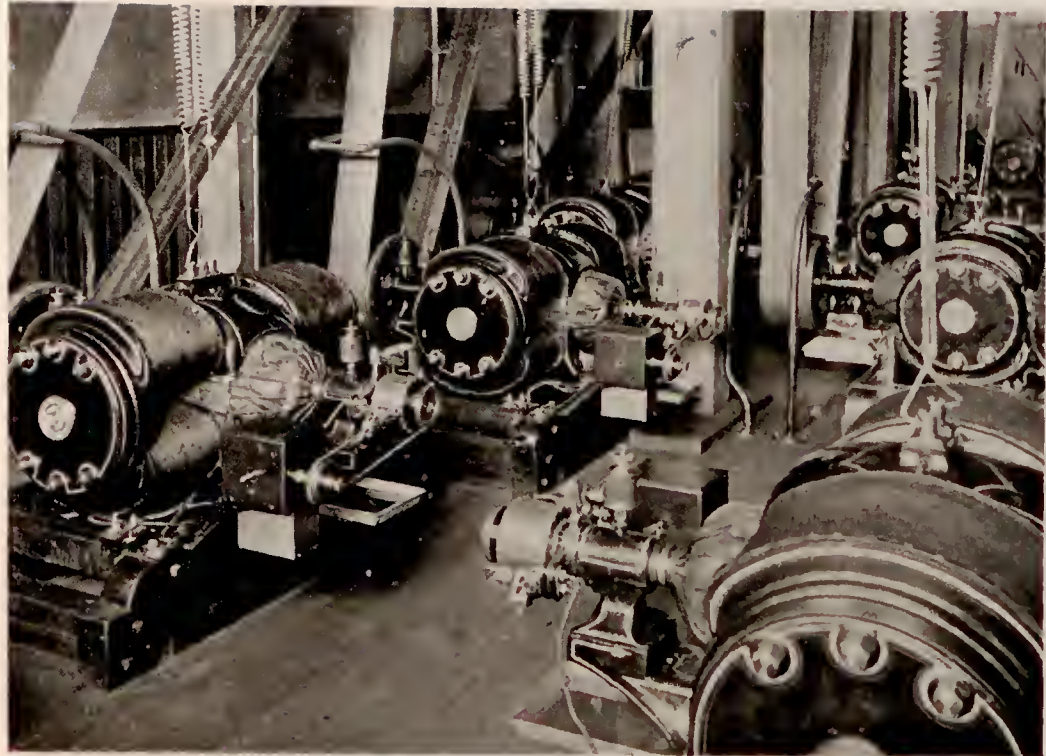


STREET CAR MOTOR, WESTINGHOUSE COMPANY

The temple is colored in warm roseate hues, with frieze of old gold and stencilling in Egyptian designs, while lotus blossoms and cut-glass jewels, lighted by hidden incandescent lamps, form the most striking decorations of the main entrances. The interior is divided into two compartments, whose rich ceilings and columns of glass are illumined by more than 1,000 changing lights, their decorative scheme including the lotus, the eagle, and the hooded serpent. Around the walls are show-cases, lined with red plush, and containing apparatus of the company's manufacture, as switchboards, receiving instruments, recorders, galvanometers, a stenographic machine for



ELECTRICITY BUILDING, NORTH FRONT



DYNAMOS OF WESTERN ELECTRIC COMPANY

company's plant at Machinery hall, half a mile away. Near the switchboard are various machines used by the company in manufacturing processes, including those which make nuts and screws, which insulate wires with silk and paper, braid the strands of conductors, and wind them upon spools, and perform a score of operations formerly done by hand. A complete exhibit of telephone apparatus is a feature of the display, including machines made by its factories in New York, Chicago, and Antwerp, and those constructed for the American Bell Telephone company. There is a large array of switchboards, showing the different styles fashioned within the past decade, with reels of cable covered with lead, and insulated with paper instead of cotton and paraffine.

In this section is the tabulating machine used in United States census work, and an ingenious mechanism whose long finger, terminating in an incandescent bulb, is continually writing in air the words, Western Electric company. Batteries and incandescent lamps are elsewhere grouped, and a portion of the space is occupied by a small scenic theatre presenting an alpine landscape, over which are cast the changing hues of night, dawn, midday, and sunset, thus showing that with skilful manipulation electric light may be shorn of its coldness and hardness, and endowed with all the rich colors of the natural rays. In a historic collection is a large portrait of Moses G. Farmer, and a handbill dated 1847,

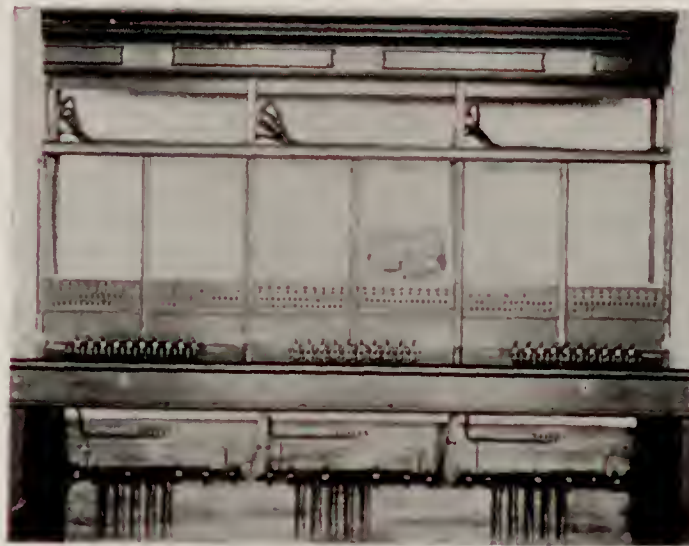
advertising the public exhibition of his recently invented electro-magnetic engine. The Farmer electric cars and incandescent lamps are still among the specialties manufactured by the company.

Adjoining the exhibits of the Western Electric company is a classic structure, with two large porticos, representing the American Bell Telephone company. At its main entrance is a broad stairway, guarded by two figures of the sphinx, over which are large candelabra of bronze, and a row of Ionic pillars opening into a court containing fountains of tasteful design. Beyond is the temple proper, octagonal in shape, through which one may pass to the opposite entrance, or examine the collections in either of the side corridors.

On one of the walls are tabulated statements showing the growth of the company's business from 1881 to 1893, and from which it appears that in the former year it employed 1,400 persons, and in the latter nearly 10,000; that at the present time it operates more than 440,000 miles of wire in and between the larger cities, and that 552,000 of its telephones are in constant use. The map on which is represented its system of long-distance telephones indicates that Boston, Washington, and Milwaukee are at its extremities, with lines between all connecting points of importance.

the use of the blind, a printing machine for telegraph operators, district telegraph and police call boxes, electric bells and buttons for hotels, elevators, and residences, in short, a collection covering almost the entire range of electric supplies.

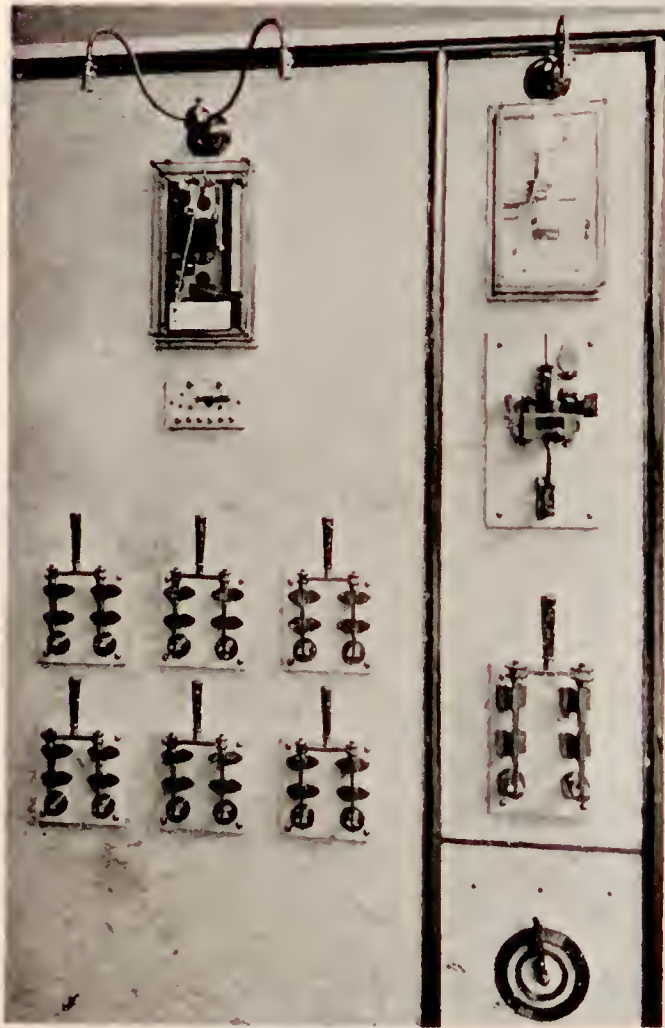
But the Egyptian temple and the electric tower by no means complete the company's display. Close at hand is a switchboard composed of slabs of Tennessee marble mounted in bronzed copper, from which issue the currents which supply both these structures, its reverse side showing the various connections, and the entrance and distribution of the circuits which originate in the



TELEPHONE SWITCHBOARD



IN THE WESTINGHOUSE EXHIBIT



WESTINGHOUSE SWITCHES



THE EDISON ELECTRIC TOWER

Telephones for the use of marine divers and those who travel by water are also on exposition.

In a series of cases covering the entire length of one of the corridors is a historic collection, representing the essential features of the telephone first constructed by Alexander Graham Bell in January, 1875, with subsequent improvements; also the Blake transmitter, the Hughes microphone of 1878, and other inventions bearing upon his patents. In the opposite corridor is a central telephone office, with a dozen or more of operators, where one may observe all the workings of what to most of us has long since ceased to be a mystery. Here is also a series of drawings and photographs, showing the underground construction of telephone systems now generally adopted in the larger cities. Within the inner chamber of the pavilion is a life size painting of Bell, and a gallery of photographs showing the buildings owned or occupied by company. In the north portico beyond is a long-distance telephone connecting with New York, its workings daily exhibited and tested.

West of the space allotted to the Telephone company is a pavilion of Grecian architecture, whose ceiling is colored in imitation of the mid-day sky. Without is a collection of magnets, coils, and dynamos, among the last being a generator such as is used in the Calumet Hecla copper mines. A space of 30 feet along the western side is occupied by the largest switch-board in Electricity hall, specially constructed for exposition, 30 feet in height, and with a capacity of ten circuits and 30,000 lights. The company has also an exhibit of switch-boards for arc and incandescent lights, with electric motors of many kinds, and a large assortment of carbons.

The Fort Wayne Electric company, whose specialty is the manufacture of appliances used in the Wood system, has a large section in this vicinity in which are exhibited dynamos, magnets, generators, switches, motors, meters, and arc, incandescent, and search lights. Here also is displayed the first dynamo built by James J. Wood, in May, 1879, weighing only eighty-six pounds, together with the various lights used in several cities of metropolitan rank in which the Wood system has been largely adopted.

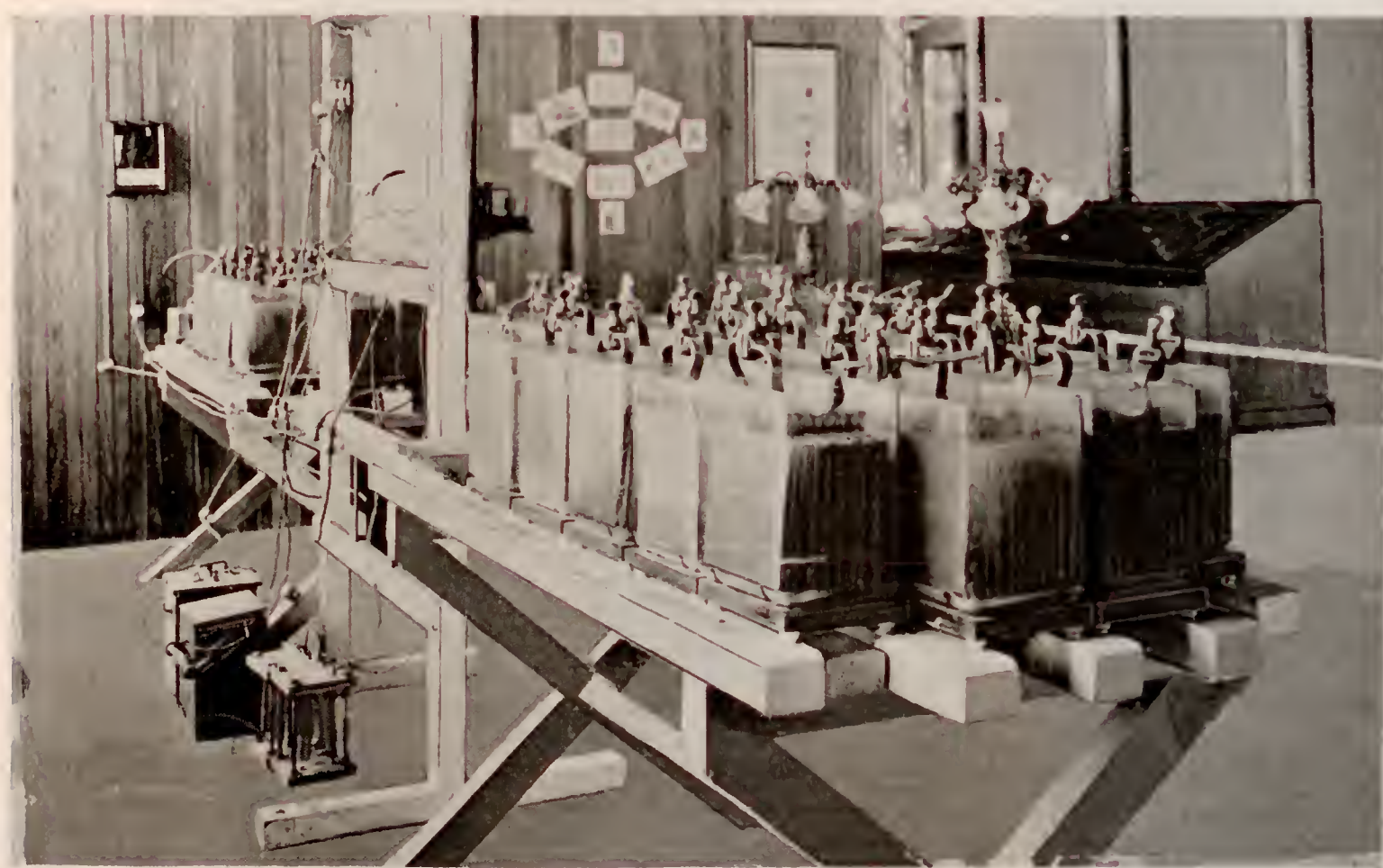
In the groups above mentioned are represented the more prominent manufacturers of electric apparatus and supplies, their collections occupying the southern half of the Electricity building, and a portion of its

northern section. But there are also numerous exhibits of a special, and some of them of a specially interesting character extending in unbroken array along the walls. Before describing them, in conjunction with the gallery display, let us first see what foreign countries have to show on the ground floor of the hall.

Among the German exhibits, occupying a liberal space in the northeastern portion of the building, may first be mentioned those of the Allgemeine Elektrizitätsgesellschaft, or General Electrical society, whose headquarters are in Berlin, but with numerous branches elsewhere in Germany and other European countries. In the

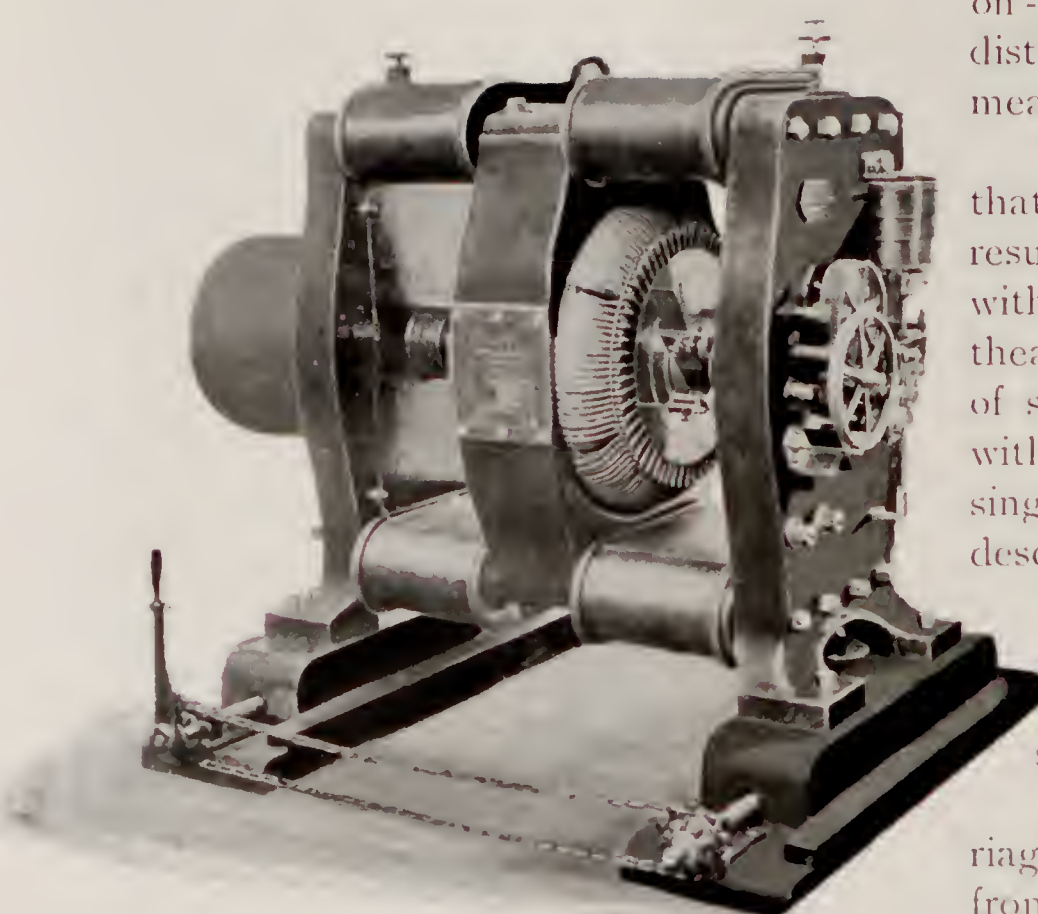


ENTRANCE TO BELL TELEPHONE PAVILION



ELECTRIC BATTERIES

centre of its space are machines for the combined transmission of power by continuous and multiphase currents, the former being supplied by a large electro-motor, furnishing 100 horse-power and making about 500 revolutions to the minute. By means of such currents power has been transmitted from Lauffen on the Neckar to Frankfort-



WOOD ARC DYNAMO

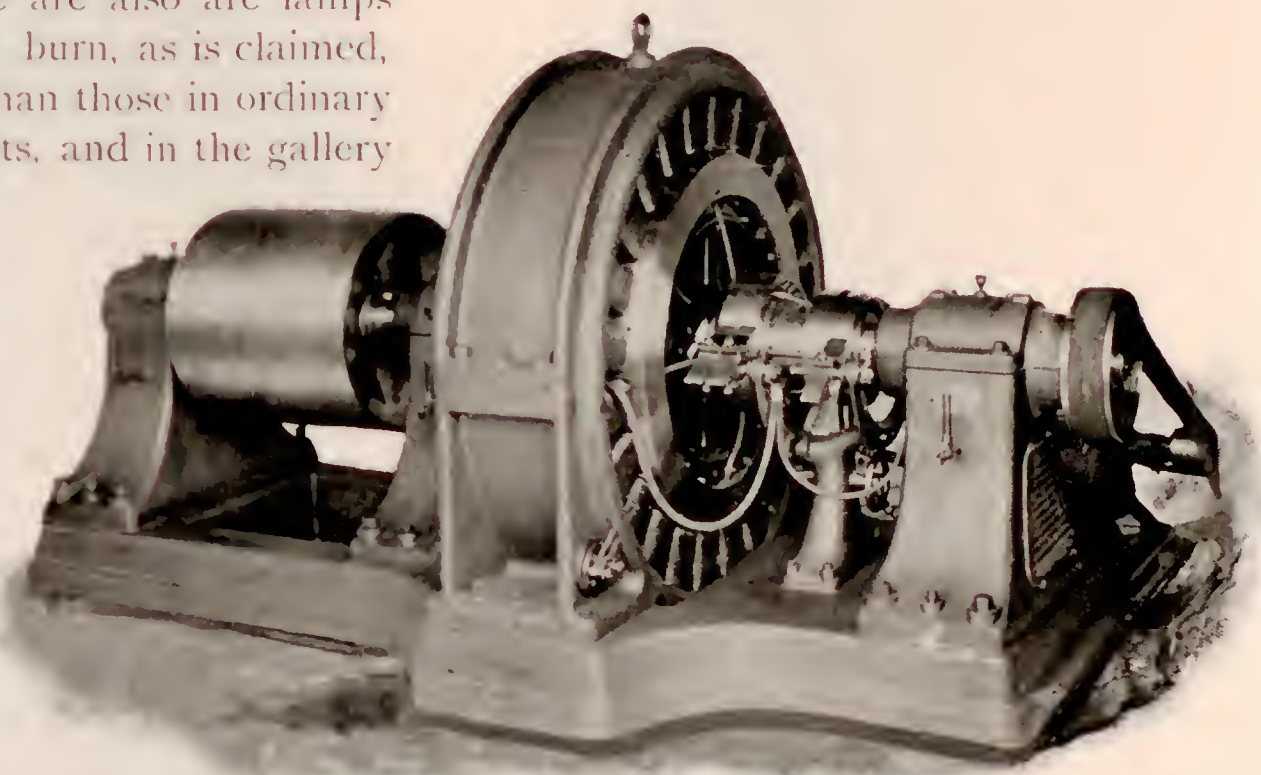
without flickering, with a clearer, steadier light than those in ordinary use; there are surveying and measuring instruments, and in the gallery is a collection of historic apparatus of which mention is made elsewhere in this chapter.

Among the exhibits by the Nuremberg firm of Schuckert and company the most remarkable are the great searchlights on the roof of the Manufactures and other buildings, as described on a former page. Felten and Guillaume of Carlsberg have a large assortment of wires and cables in coils and cross sections, many of them arranged in the form of pyramids, with barbed, braided, and other wires of many varieties and in many forms. Hartmann and Brown have numerous specimens of apparatus, manufactured at their works near Frankfort on the Main, where are produced surveying and measuring instruments, galvanometers, magnetometers,

on-the-Main, more than 100 miles apart, this being the longest distance to which electric power has been transmitted, though by no means the limit of distance.

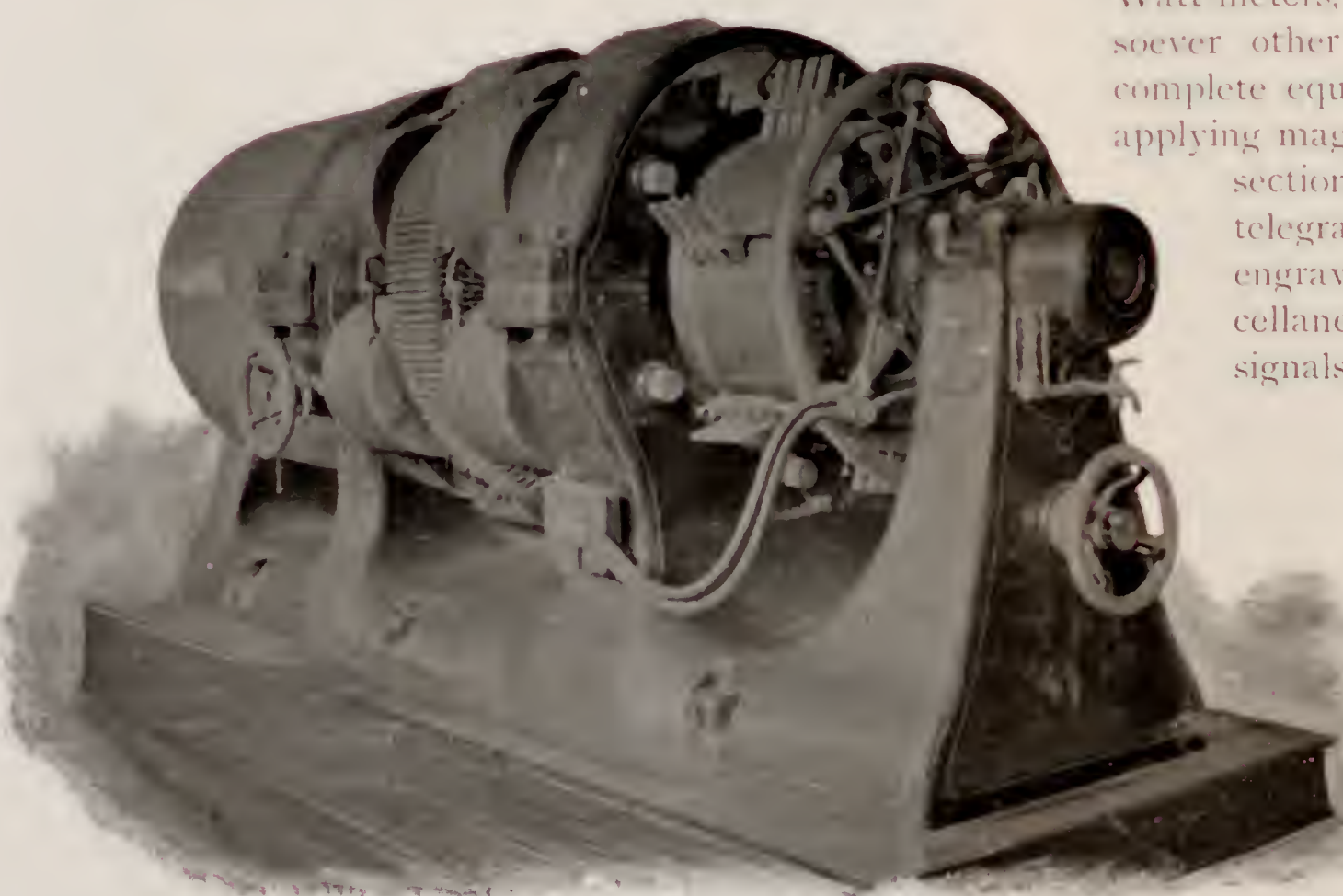
An interesting display is the stage-lighting apparatus, so arranged that its action may be observed from any point of view. This is the result of many years of study and practical experience in collaboration with specialists, and is now being largely used in German and other theatres. By it are produced the broad glare of noonday, the glow of sunset, the silvery shades of moonlight, and the grey hues of dawn, with lightning flashes and other intermittent phenomena, all by a single instrument connected with colored lamps. Of arc and incandescent lamps there is also a number of specimens, with motors and materials for electric railways, apparatus for storage batteries, conductors, conducting and insulating materials in many varieties, measuring and controlling instruments, electric clocks, railroad signals, and appliances for heating and cooking.

By Siemens and Halske of Berlin is exhibited a railway carriage, driven by a three phase current motor, the current transmitted from a distance, and reduced by a transformer to the strength required. There are also lamps which burn, as is claimed,



THE NEW WOOD DYNAMO

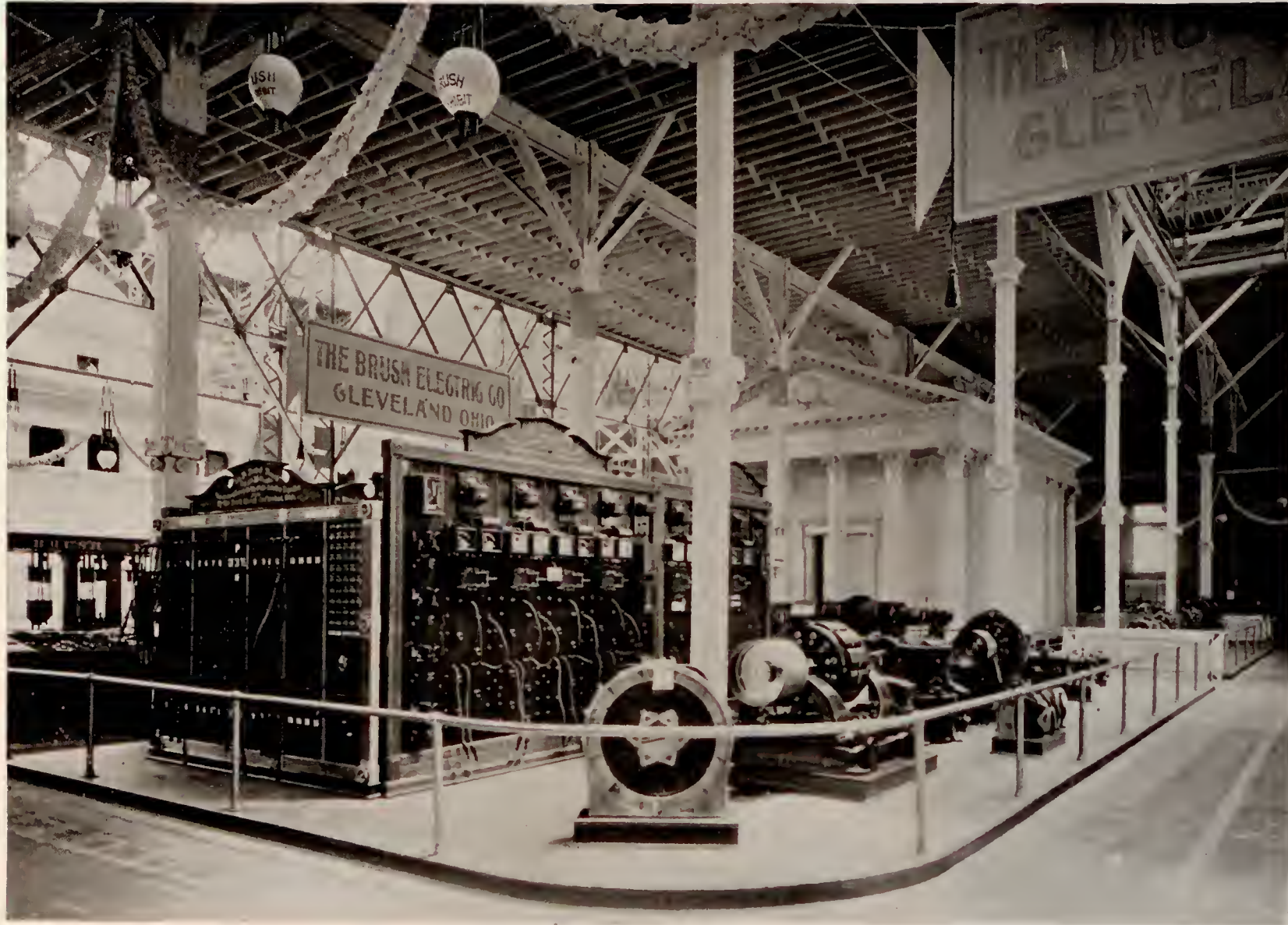
Watt-meters, volt-meters, ammeters, pyrometers, and whatsoever other meters are known to electrical science, with complete equipments for laboratories, and mechanisms for applying magnetic tests to iron. Elsewhere in the German section are machines and lamps for electric lighting, telegraph and telephone instruments and appliances, engraving and electro-plating apparatus, and miscellaneous exhibits, as of burglar and fire-alarm signals, lightning rods, and electric toys.



DISPLAYED BY THE SHORT COMPANY

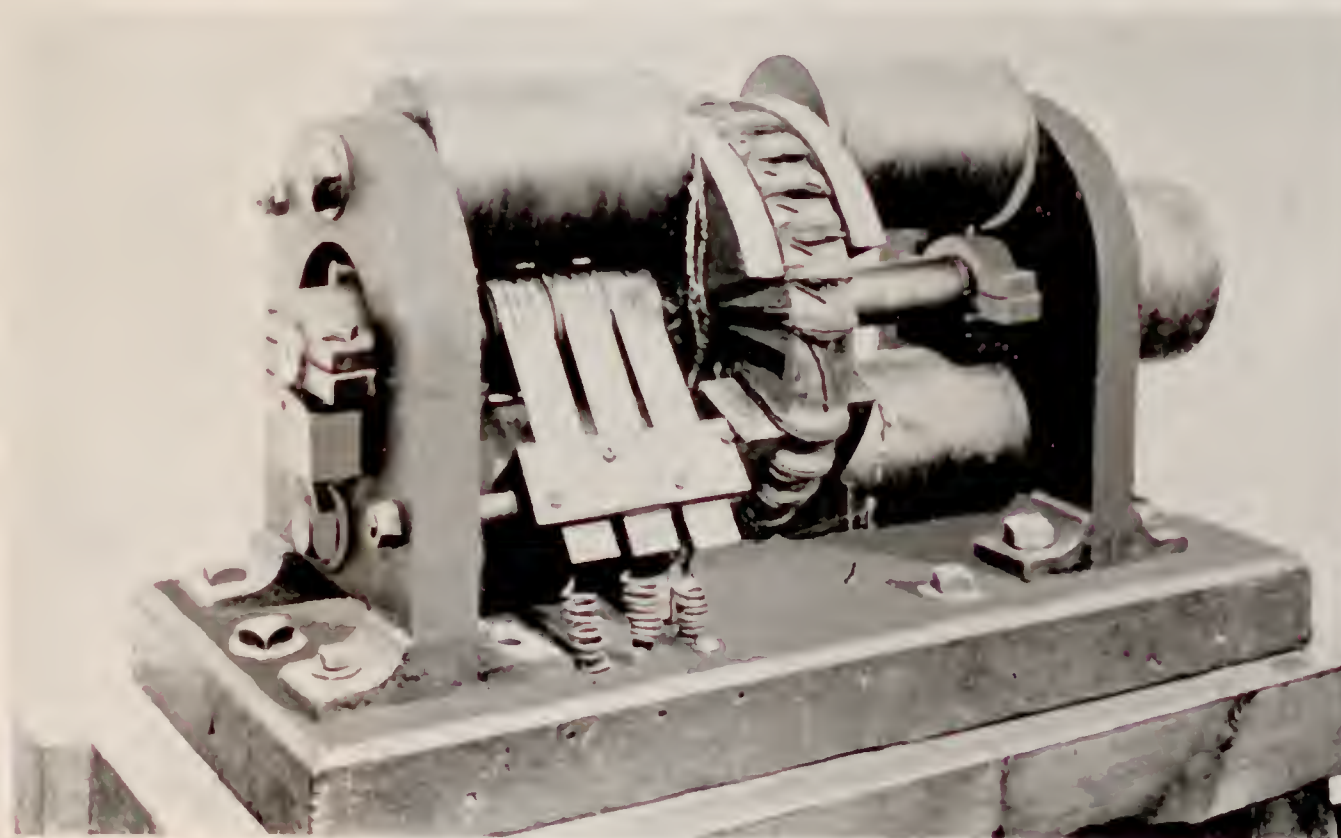
for ascertaining the resistance of electric currents, and for measuring their speed. The multiplex telegraphic system of E. Mercadier, director of the polytechnic school, is illustrated by a collection of apparatus. By means

The French section adjoining on the north the exhibits of the General Electric company, contains both national and private collections, the former chiefly in the northwestern corner of the main floor. Here are explained the telegraph and telephone systems organized and operated under government control, and there are self-acting instruments registering changes in temperature, atmospheric moisture, and direction of wind. In one of the cases are machines for testing cables,



On the walls of this section are maps showing the routes of telegraph and telephone lines, and diagrams illustrating the development of the telegraphic system since 1851. As the exhibit is specially made by the department of posts and telegraphs, pictures are also shown of the quarters occupied by the government telegraph force. This consists of about 900 employes, the department representing a system which embraces 178,000 miles of wire, and despatches 40,000,000 a year of telegrams. To the telephonic systems there are more than 11,000 subscribers.

Among the private exhibits are large collections of apparatus for lighting, power transmission, and miscellaneous purposes. A prominent feature is the appliances used for lighthouses, with the most powerful of reflectors and revolving beacon lamps, casting a blinding glare as seen at night in operation. Of special interest also is the electric cupola and furnace of M. Moissan, in which that young French scientist has developed a heat up to 9,000 degrees of Fahrenheit. By A. Piat and Sons of Paris and Soissons is displayed a hydro-electric riveter, driven by a combination of hydraulic



A BRUSH DYNAMO



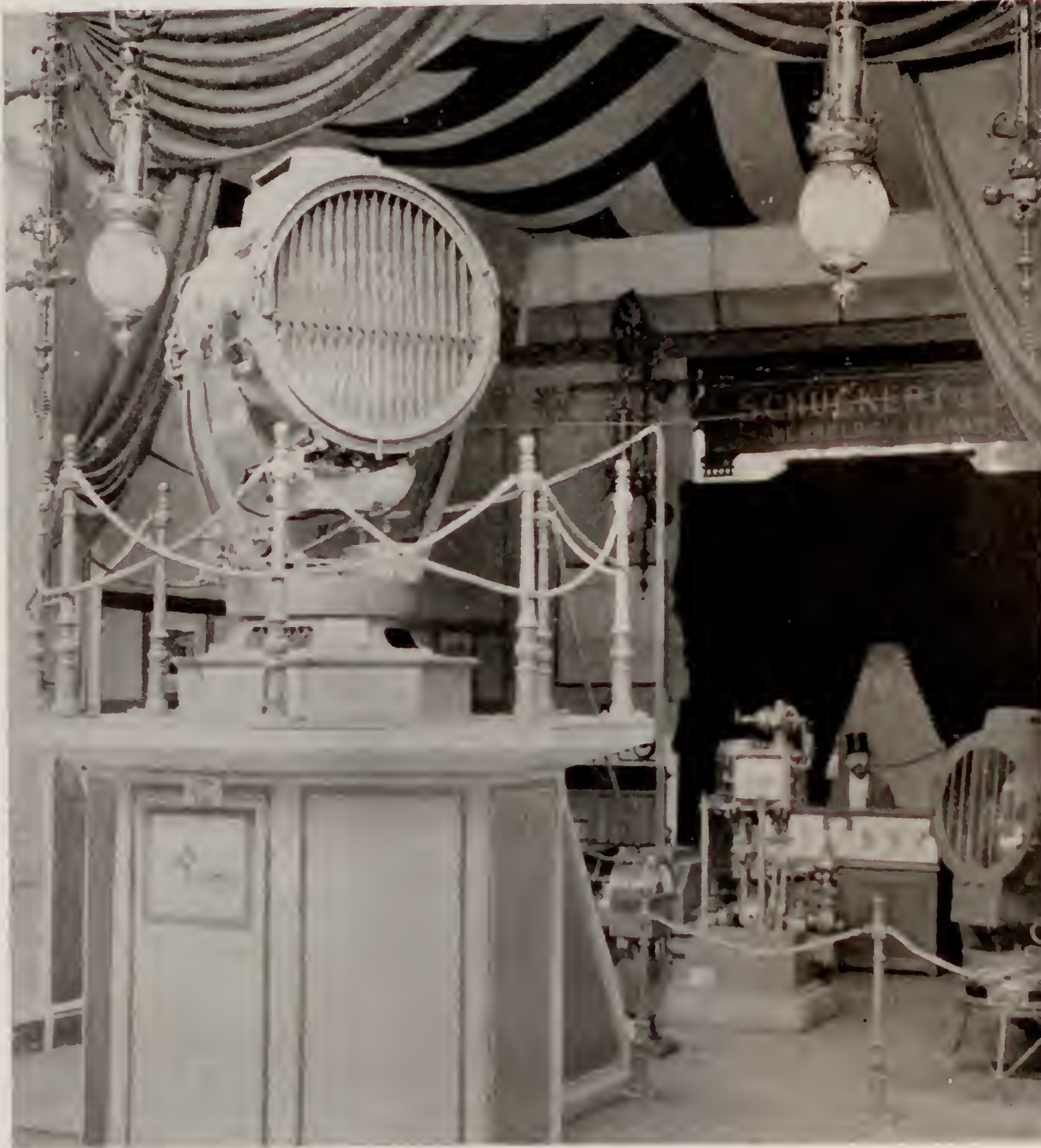
NICKEL PLATING MACHINERY

of rapid alternate currents it is possible to use the same wires with multiplex and simple instruments, the former transmitting twelve telegrams in one direction, or transmitting and receiving the same number simultaneously. Mercadier and others have several multiplex printing machines, and there are automatic transmitters, a sextuple telegraph, and a model Morse station of four lines. A curious instrument called the Caselli autographic telegraph, patented in 1864, has for its object, as yet only partially realized, the fac-simile transmission of writing.

pressure and electricity, and largely utilized for bridge work. For this and other riveting machines manufactured by the firm special advantages are claimed, some of them having been used by the department of public works, as for the erection of 1,000 feet spans over the river Loire. Elsewhere in the French section are exhibits similar to those of Germany and the United States, together with such scientific curiosities as electric matches, musical appliances, and apparatus for towing vessels, based on the principle of magnetic adherence

In the British section, west of the French exhibits, the most attractive feature is the collection of telegraphic apparatus contributed by the government, dating back to 1837, including the first specimen of underground telegraphs, and the earlier needle and other primitive instruments, all contrasting somewhat strangely with the modern appliances at their side. Add to these a few private exhibits, with those of the London branch of the

General Electric company, and we have about all that Great Britain has to show us in this department. Among the former may be mentioned the display of the Homacoustic Speaking Tube company, consisting of attachments for voice tubes, and a homacoustic commutator with electric signalling device.

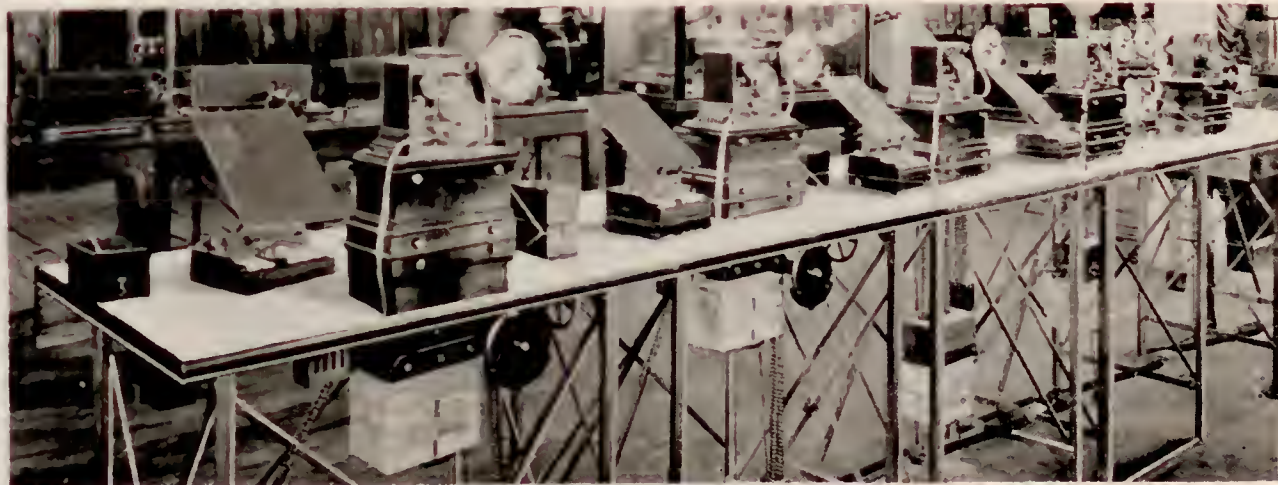


ONE OF SCHUCKERT'S SEARCH LIGHTS

Near the northwest corner of Electricity hall is a tasteful structure, the purpose of which, except for ornament, does not appear until approaching close to it we find here a tower-like fabric composed almost entirely of carbons, cored and solid, and varying from an eighth of an inch to three inches in diameter. This is the exhibit of the Vienna firm of Hardtmuth and company, one of the largest of European manufacturers, and by which have been overcome the more serious difficulties in supplying a carbon adapted to modern conditions. Though more expensive than those of American make, it is claimed that this is more than compensated by superior efficiency, and thus it is that from the agents of the firm large quantities were purchased for use on the incandescent circuits within the Exposition grounds, for the illumination of the central court and basin, the electric fountains, and the battle-ship *Illinois*.

In the northeastern portion of the hall, near an array of noisy phonographs, is a

collection of silent and motionless instruments which have a deep meaning to the Japanese and all other peoples who live in dread of earthquakes. It represents the exhibit of the Earthquake laboratory of the imperial university of Japan, and the instruments, known as seismographs, were invented partly by natives and partly by Europeans, not only to record the direction and violence of shocks, but to foretell their approach by indicating the slightest tremor of the earth's surface. The first earthquake instrument ever constructed, a drawing of which is displayed on one of the walls, is claimed as a Japanese invention, and bears date A. D. 132. In the more perfect machines of the present day the main feature of their construction is that during seismic disturbances they work from stationary points, and for minor shocks at least the diagrams written on smoked glass and paper are considered by scientists to be true measurements of the earth's motions.

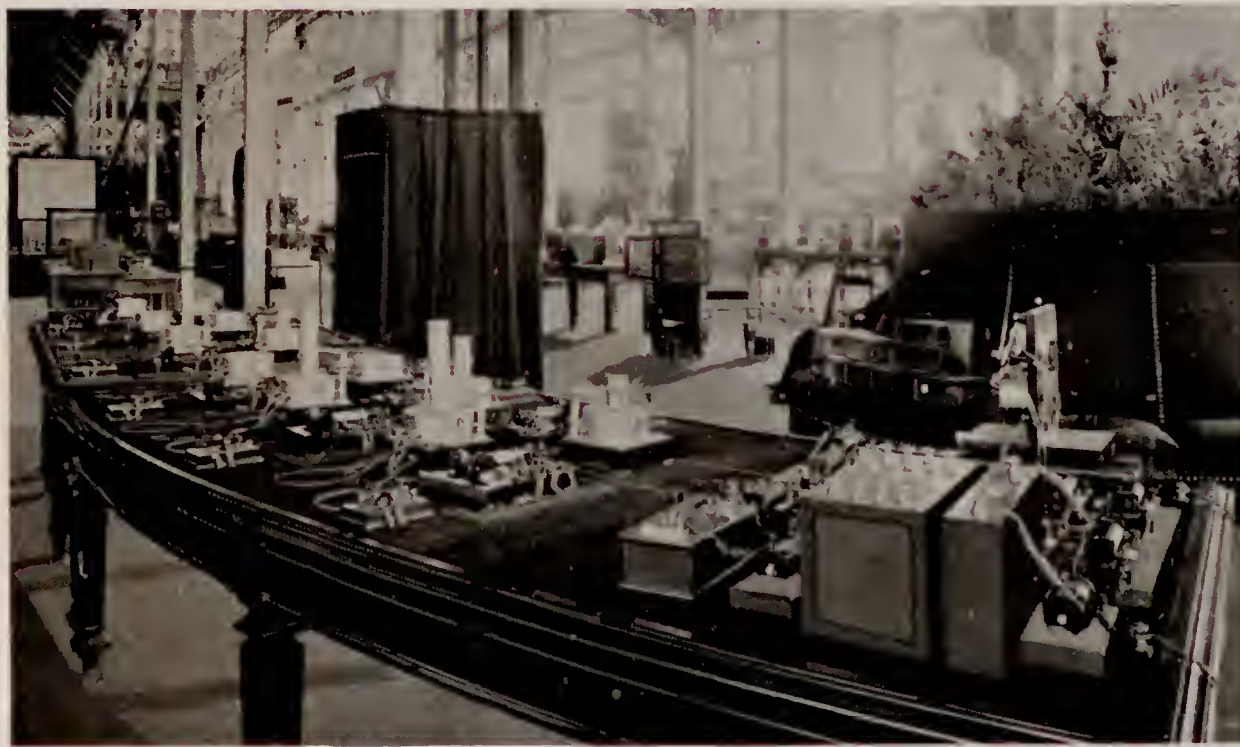


BOUDOT'S PRINTING MACHINE

Many instruments are here exhibited, of different patterns and intended for various purposes. Upon the slightest disturbance of the earth the electric circuit is closed, and the machinery set free which drives the recording surfaces on which the diagrams are written. In one style of instrument this consists of a smoked glass revolving plate, the lines being written upon it by horizontal pendulums and vertical spring levers, both motions of the earth being thus registered. But whether the record is made in this fashion or by pencils upon bands of paper wound on drums, the machinery is kept in motion by electric clock-work, the rate of revolution is marked by an electric time ticker, and when convulsion or tremor ceases, the current is broken and the mechanism ceases to work.

Special instruments are used to record violent motions, wave-like undulations, and small, local displacements. A type of the last named is known as the mantel-piece seismograph, and is intended for the use of those who simply wish to know the direction and nature of motion as recorded at their own residences. The tremometer

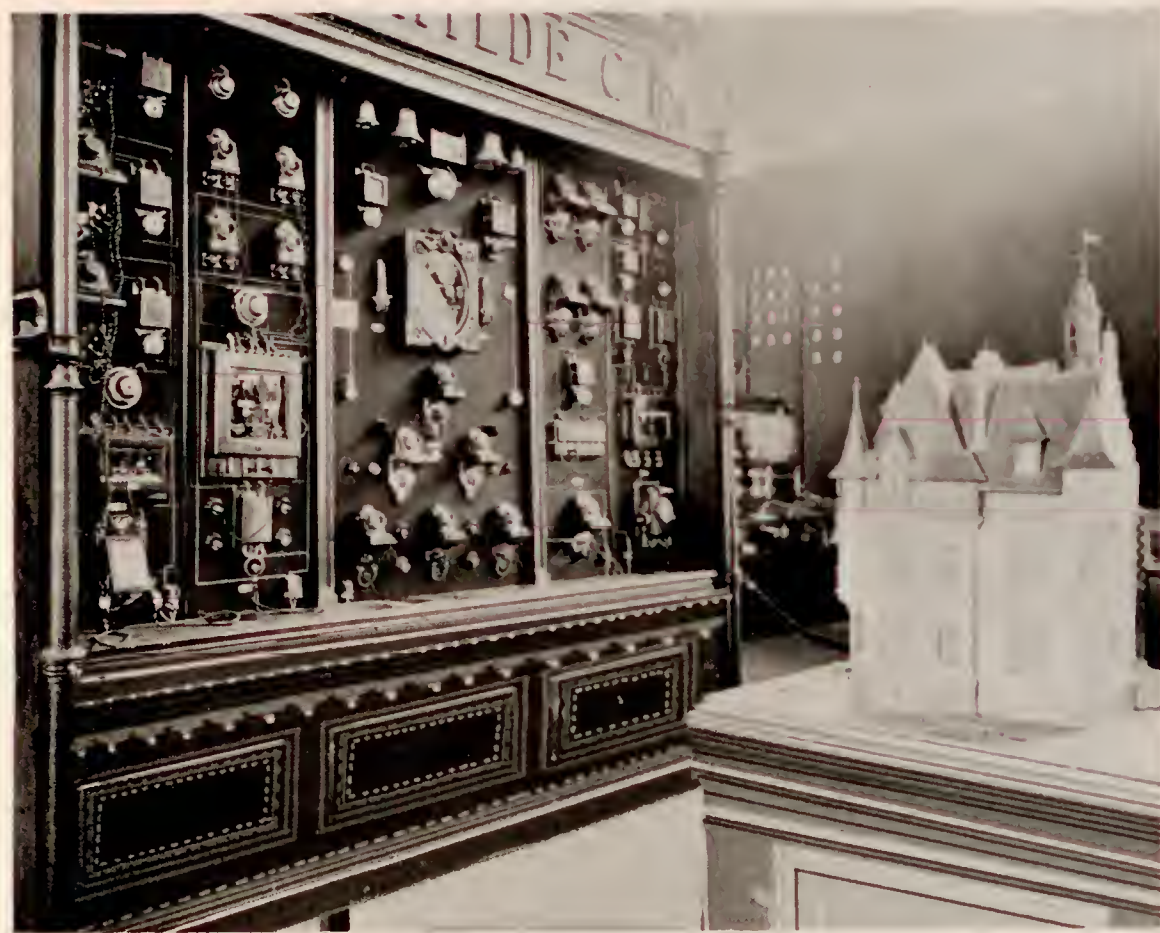
is one form of an instrument used to record slight earth tremors, such as are common to many countries. Its essential feature is a delicate pointer from which electric sparks are discharged upon a band of paper, automatically moving across a brass table. If the pointer and the earth are at rest, then the holes which are burned are recorded in a straight line; otherwise, the bands of paper are perforated in all directions around what would be the normal line. A more satisfactory and recent method of registering these motions is by means of a continuous photograph of a ray of light reflected from a small mirror attached to an extremely delicate horizontal pendulum. There are also in this group a clock for recording the duration of an earthquake, and several safety lamps which, if overturned, are at once extinguished. Under a glass case is a mass of wire, bent and twisted in all directions, representing the trend of the shocks during the great convulsion of January 15, 1887, the numbers at different points indicating the seconds of their duration.



MERCADIER'S MULTIPLEX TELEGRAPH INSTRUMENTS

Near the collection of instruments from

the seismological laboratory is a series of pictures representing ruined buildings, dark fissures in fields and valleys, bridges hurled into rivers, and other effects of such convulsions as those of 1887 and 1891. Here alone is a sufficient explanation of the interest taken by the Japanese in the study of seismic phenomena, whereby they hope eventually to obtain such scientific data as will enable engineers to build structures that will withstand the strongest shocks and the most complex motions of the earth.



FRENCH TELEPHONES

be operated either by electrical or water power. By the former process it is claimed that coffee may be ground at a cost of five cents for every hundred pounds. Other of its exhibits are a combined water motor and dynamo, and a combined engine and dynamo, both of which are among the most powerful mechanisms of their kind.

On either side of the southern portal are exhibits of motors, the largest by an electric motor company of New York, which has also fans for ventilating ships and large buildings, with blowers for forges and furnaces, pumps for mining operations and water works, travelling cranes and hoists, organ bellows, elevators, mill machinery, and telephone and telegraph apparatus. Opposite is the dainty bronze pavilion of the Indianapolis company, another manufacturer of electric power machinery. Near the western entrance of the hall, the company which operates the movable side-walk at the lake pier has a large collection of generators, motors, dynamos, and appliances for incandescent and arc lighting. For its so-called Novak lamp, outlined on the pavilion in letters of light, it is claimed that this is the only incandescent lamp that retains to the last its original candle power.

Electric motors, with their application to street, underground, and mining railways, and to machinery in general, are displayed in various portions of the hall and galleries, as well as in the Machinery and Transportation buildings. On the ground floor a factory at Portland, Maine, has among its collection a coffee mill which can



LIGHT HOUSE REFLECTORS, FRENCH SECTION

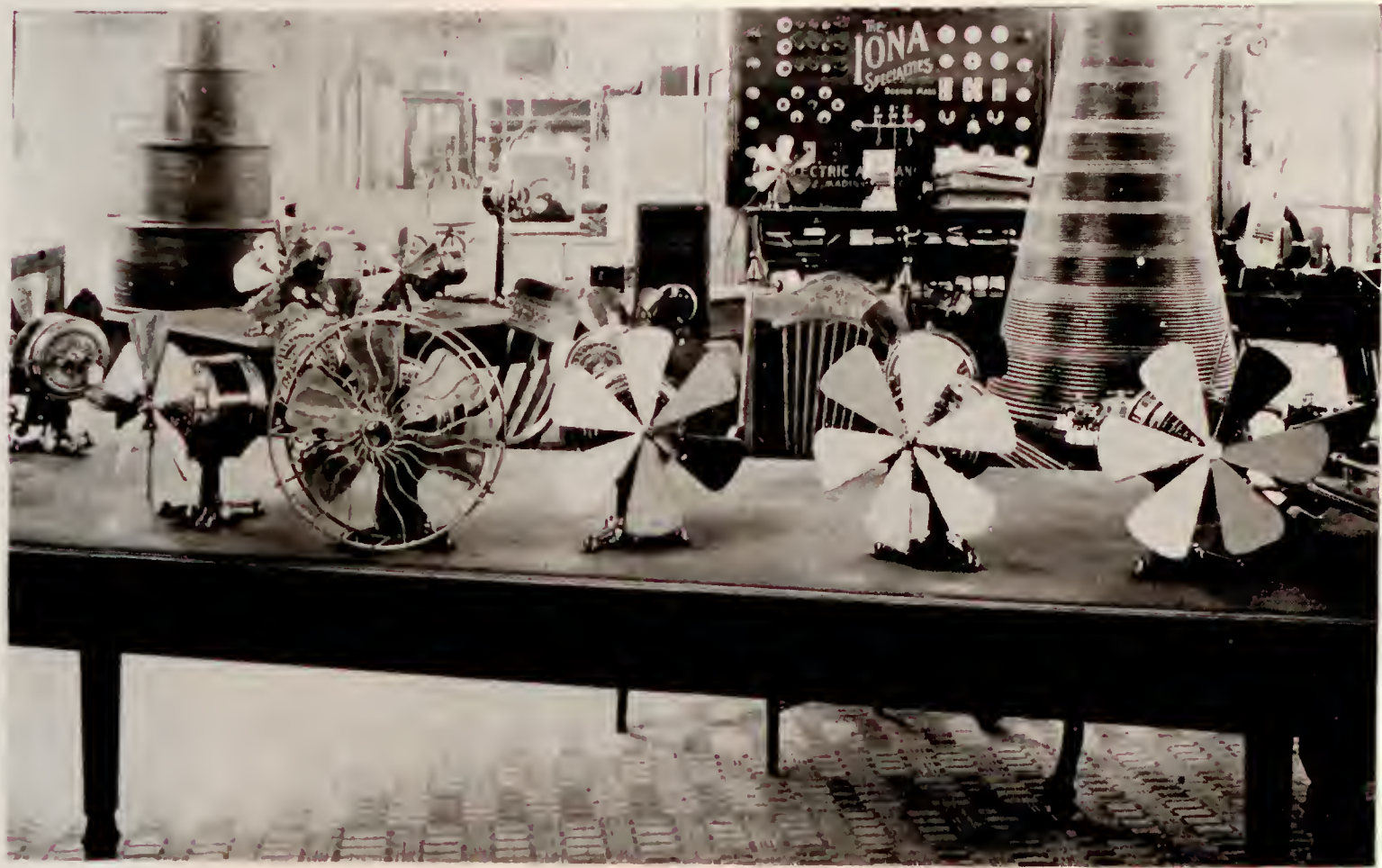
The largest manufacturers of electrical machinery who exhibit in the body of the hall, make a specialty of supplying street, underground, and elevated railroads, with their operating apparatus. There are also several companies whose operations are restricted to these specialties, a Cleveland firm displaying one of the simplest of all such mechanisms, a single motor suspended on rubber cushions from the truck frame, so protected that it cannot be injured by heat or cold, dust or gravel, water, snow, or slush. Another company shows a gearless street-car motor, for which it is claimed that few of its appliances will either wear out or injure any of the surrounding parts.

Near these exhibits is a collection of machines made by an electric welding company, of Boston, and largely used by manufacturers. The current is made to pass through the ends of the metals that are to be

welded, the heat being generated at the point of contact, and whether it be required to fasten strands of wire or the links of a watch chain, or to forge steel projectiles of war, the joints of rails, or the chain armor of an iron clad, the result is uniform. Shells and other projectiles used by the government are welded by this company, and there are here on exposition sheets of wrought iron, four inches thick, which have been pierced by shells at a distance of ninety feet, their lines of juncture still remaining intact. Thus also are welded metallic coils; fences and wheels are thus welded, the several processes being daily illustrated by machinery in operation. Side by side with small machines worked by hand are those whose beds are many feet in diameter, but the adjustments of each are so perfect that in every instance the welding is performed with the utmost precision.

On the opposite side of the hall is another exhibit by a Boston firm, which also forges by electricity. Both companies manufacture switches, rheostats, safely appliances, and various apparatus for the transmission and regulation of the electric current, and by several companies are displayed cement-lined pipes and

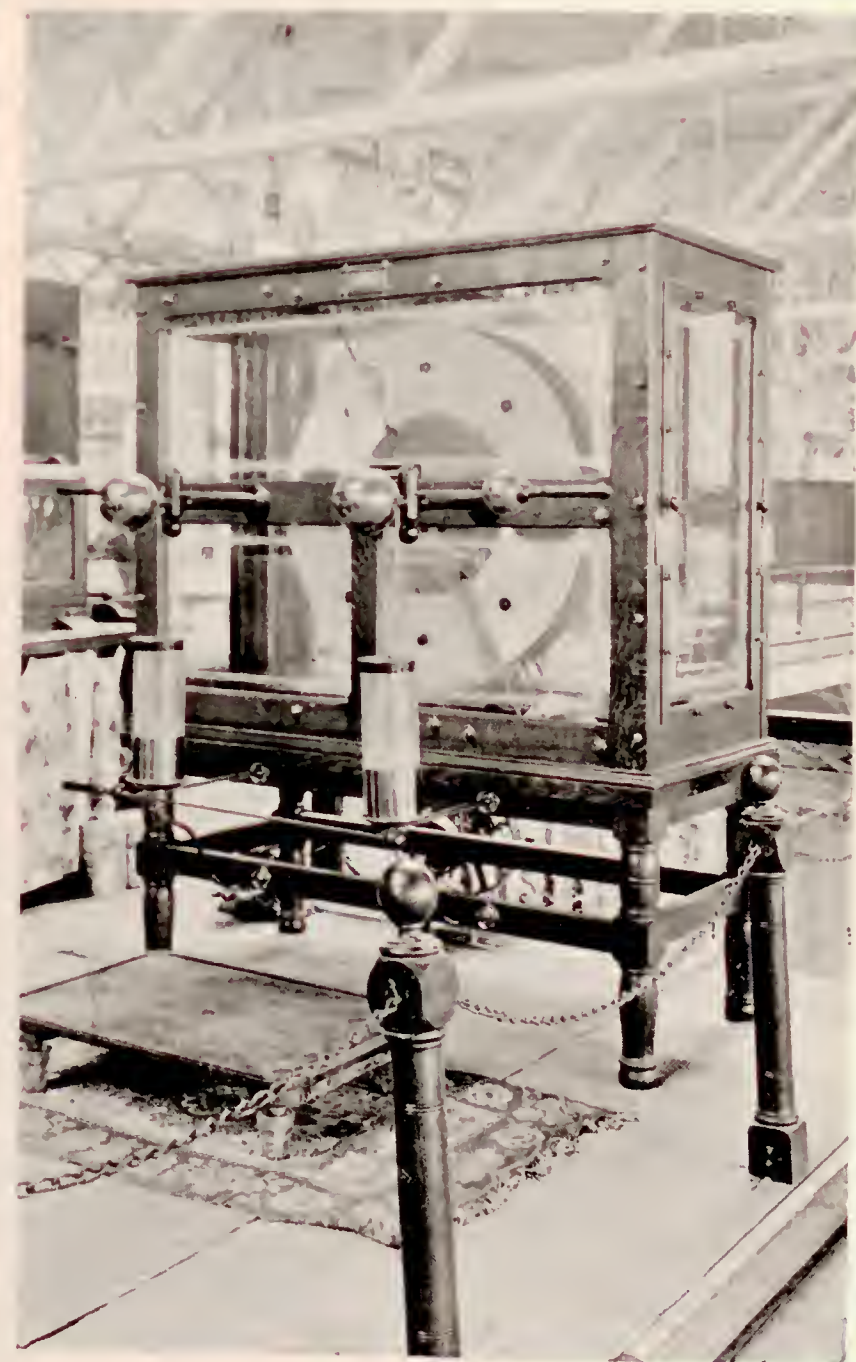
other conduits, chiefly for underground service. Makers of insulated cables and wires, tapes and compounds, are mainly represented in the galleries, but on the ground floor a Massachusetts company has specimens of its so-called insulac, claimed to be impervious to oil and other substances which interfere with electrical circuits, and said to possess four times the resistive power of the finest grade



ELECTRIC FANS



PYRAMID OF COPPER WIRE



THE HOLTZ INDUCTOR

of shellac. As the discovery of a perfect insulating compound is one of the problems of the day, such exhibits are of special scientific interest.

In various sections surrounding the main body of the hall is machinery, at times in operation, for electrotyping, plating, gilding, and nickeling, with such as is used for separating metals from their ores or alloys. A Chicago company shows the first electro-magnetic machine, made in 1844 for an English firm, claiming that



GRAY'S TELAUTOGRAPH

its own apparatus is in the line of direct succession. Besides electrotyping and electro-plating, this company makes a specialty of polishing, lacquering, and buffing, a section of a walrus hide, thick and firm as a board, showing the chief material for the wheels used in these branches of work.

In the construction of electrical apparatus, as of other machinery, belting plays an important part, and here are on exposition many varieties specially made for operating dynamos and engines. Some of the belts are fastened with cement, and others with wire screws, but as a rule belting for heavy machinery should be perforated, and of such there is a

large collection. By a New Hampshire firm is exhibited what is claimed to be the largest piece of link-belting in the world, 200 feet long by five in width, with a weight of 4,200 pounds, and in the construction of which were used more than 400,000 pieces of leather and metal.

Of the special mechanisms displayed in the galleries there are also a few exhibitors on the ground floor, their groups including appliances for lighting purposes, for surgery, dentistry, and the diagnosis of diseases. Among the first is a small battery and spark coil which can be attached to burners and used for lighting or turning off gas. This, it is claimed, is an economical device, for the battery will last a year, and can be replaced for twenty-five cents.

The largest exhibits of surgical and medical instruments are by a New York company, which confines itself to such as are used for cauterizing and diagnosis, and by a Philadelphia establishment which also covers this ground, and produces besides, small dynamos, batteries, coils, condensers, voltmeters, testing keys, and the numerous minor forms of electric apparatus used by educational institutions.

In the western galleries of the Electricity building are some of the most interesting of its contents, for here are several of the more remarkable among recent inventions. First of all may be mentioned the telautograph of Elisha Gray, who shares the honors with Edison and Bell in the domain of electricity. In 1887 he completed and later simplified the machine by which fac-simile writings or drawings are transmitted. As now exhibited, it consists of two instruments at either end of the telegraph line, both contained in a wooden case somewhat smaller than a type-writing machine. To the transmitter is attached a pencil, and near its point is a collar, to the opposite sides of which are fastened two silken cords, passing thence at right angles around a small drum, revolving on a vertical shaft,



EDISON'S PHONOGRAPH

to which is attached a toothed wheel, the latter, as it turns with every motion of the pencil, acting on the wire with which it is in contact. Two wires are thus required to transmit the writing, the escapement wheel of the receiving instrument responding to every motion of the drum and the toothed wheel of the transmitter. At the receiving end of the line the order of the mechanism is reversed, the wheels being mounted on the shafts above the drums, with cords running from the latter to aluminum pens of the self-feeding or fountain type. As the wheels and drums are of the same size, the record made by the receiver is a fac-simile of the transmitted manuscript. The invention is of special value not only to business men, but to journalists, and those engaged in the detection of criminals.

In addition to the Edison exhibits of electrical appliances, forming a portion of the General Electric company's display, is a section in the southwest



TEMPLE BUILT OF CARBONS

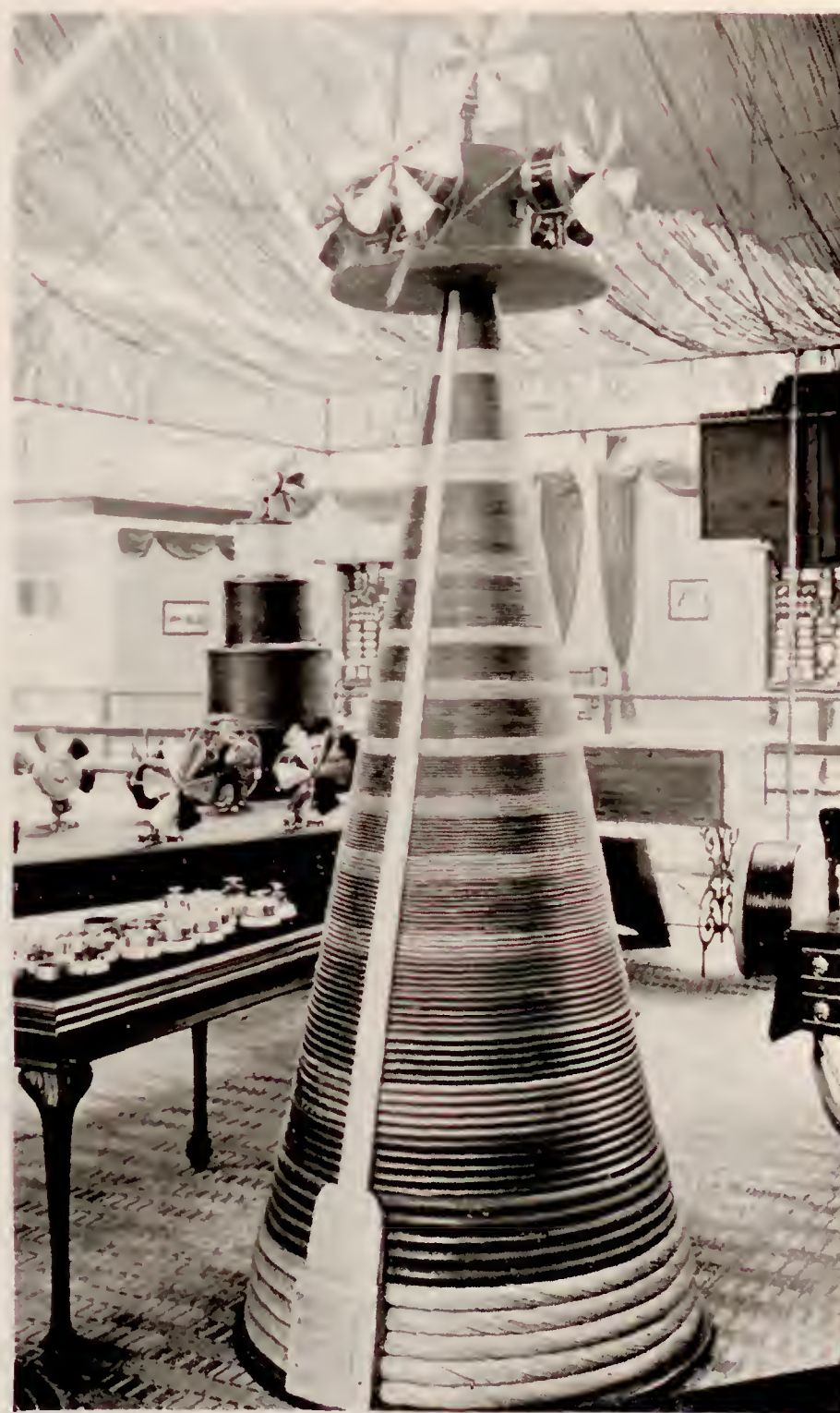


JAY'S KENITE PAVILION

of tin foil then used for the purpose has given place to the hollow cylinder of wax, upon which, as it revolves, the point of the diaphragm cuts the lines of sound. Apart from the amusement derived from this machine, it is rapidly finding favor among professional and business men, taking the place of the amanuensis, while through its records scientists are enabled to make a more thorough investigation as to the nature of wave sounds.

In a brilliantly lighted pavilion is the ingenious exhibit of the Commercial Cable company, representing an enterprise founded nearly a decade ago by John W. Mackay, of California, and James Gordon Bennett, of New York. In general terms, it consists of a working model of their system, showing automatic transmitters, recorders, and other instruments of most approved and modern type. The hair lines of the recording machine are produced at the rate of about one yard per minute, the message being ground out from the other end by the automatic sender. Instead of being transmitted from New York to Europe via Nova Scotia and Ireland, the words are simply conveyed across the pavilion, but for all practical purposes the illustration is complete. In this collection also "faults" cut out of cables, showing the nature of the accident or defect, one of the specimens having been crushed into an almost shapeless mass and nearly severed by an ice-floe. There are also instruments for detecting breaks and injuries from whatever cause with a

gallery containing the instruments of the Edison Manufacturing company; and in this locality, more perhaps than elsewhere in the Exposition, is represented the genius of the inventor. When first it was reported that Edison had constructed a machine which would store conversations, speeches, songs, orchestral music, and any other sounds given into its keeping, and reproduce them at any future time there were many who refused to believe it, and not until his phonographs were displayed at the Paris Exposition of 1889, were all the skeptics converted. Since that date the sheet



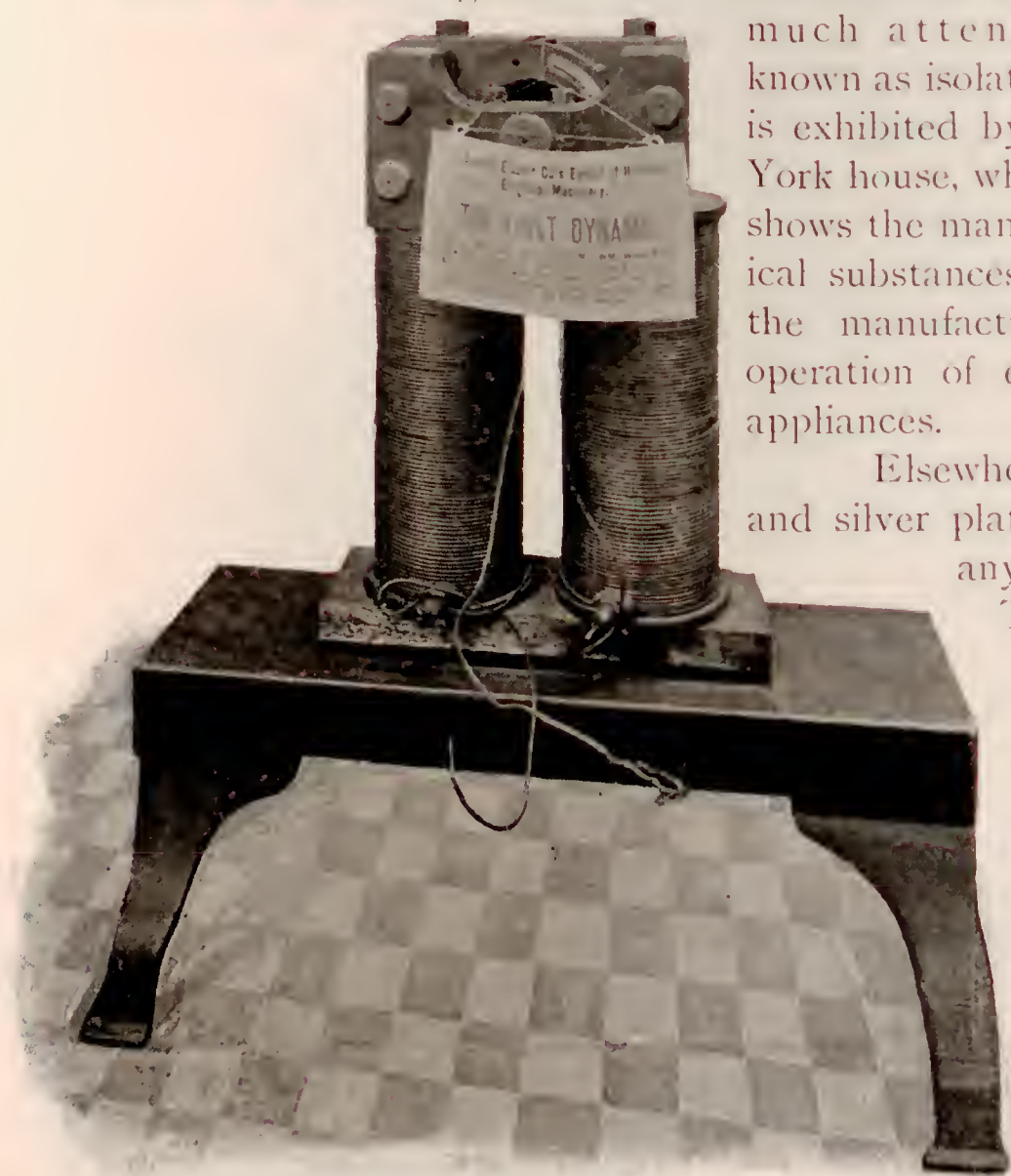
TOWER OF INSULATORS



CABLE TWISTING MACHINE

cylinder containing a galvanic battery and an inhaler, designed to relieve the sufferer from nervous and inflammatory disorders.

In this vicinity are several groups of electrical appliances which illustrate the investigations of scientists and manufacturers with a view to discover the best insulating agency. There are sheets and conduits, compounds displayed in bulk, and various kinds of paint which, it is claimed, will effectually shut off the electric current from all disturbing influences.



One that has attracted much attention is known as isolatine, and is exhibited by a New York house, which also shows the many chemical substances used in the manufacture and operation of electrical appliances.

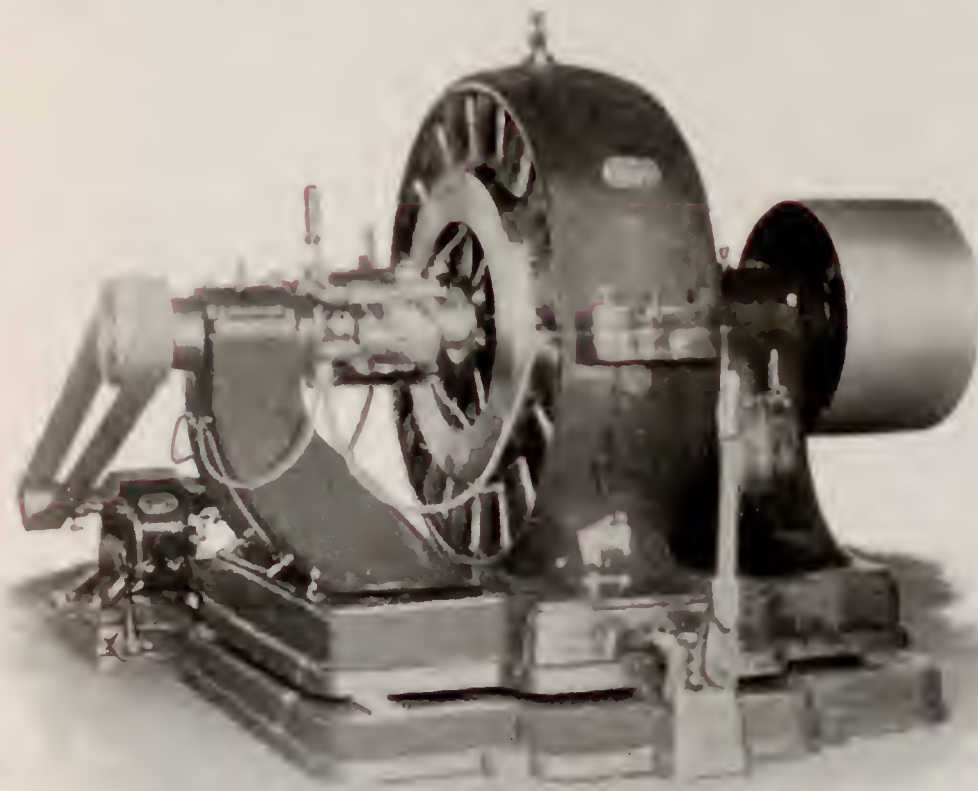
Elsewhere in this neighborhood may be studied the processes of gold and silver plating by electricity, and a simple yet effective machine by which any metal may be automatically engraved through the same agency.

The letters are securely clamped, and as the stylus follows their outlines an electric current is formed, and a corresponding motion imparted to the graver. Little practice is required to operate the machine with satisfactory results for the simpler kinds of work. In these western galleries are also electric doors, automatic guest calls for hotels, burglar alarms, and clocks which record the rounds of the night watchman, such as are used by the government, and in the buildings of the Exposition.

Close at hand one may study the system of an electric signal company; in a neat railway model marked "dangerous;" he may have a suit of clothes cut by an electric machine, or may seat himself in an easy chair while his

machine that registers the amount of resistance which the current meets in passing through a given cable, each mile of the line being divided into units of resistance. When a break occurs in the current, the amount of resistance remaining is divided by the number of units to a mile, and thus the exact point of the damage is ascertained. In the centre of the group is a handsome model of the company's repair ship, *Mackay-Bennett*, all the cable machinery on deck being a reproduction of the actual apparatus, and illustrating the process of picking up and laying cables. Specimens of perfect cables are also shown, one of the latest pattern being intended for shallow waters, and to resist rough usage, for which purpose it is covered with short sections of heavy steel tubing, so adjusted as not to impair its flexibility.

As already stated, the majority of the electrical instruments used in surgery and dentistry, and in the treatment of various physical ailments, are to be found in the galleries. One of the most elaborate exhibits is that of a Chicago physician, whose specialty is an electric belt for which he claims wonderful cures of nervous affections. However this may be, the observer cannot fail to admire the pavilion in which he displays his apparatus. Adjacent to the Edison collection, a portion of the space is occupied by a handsomely furnished parlor, in which are valuable oil paintings. Near by is the exhibit of an electric medical supply company, consisting of stethoscopes, batteries, and appliances for electric treatment, cautery apparatus, and special contrivances used in surgery or dentistry. Among other curiosities is a small rubber

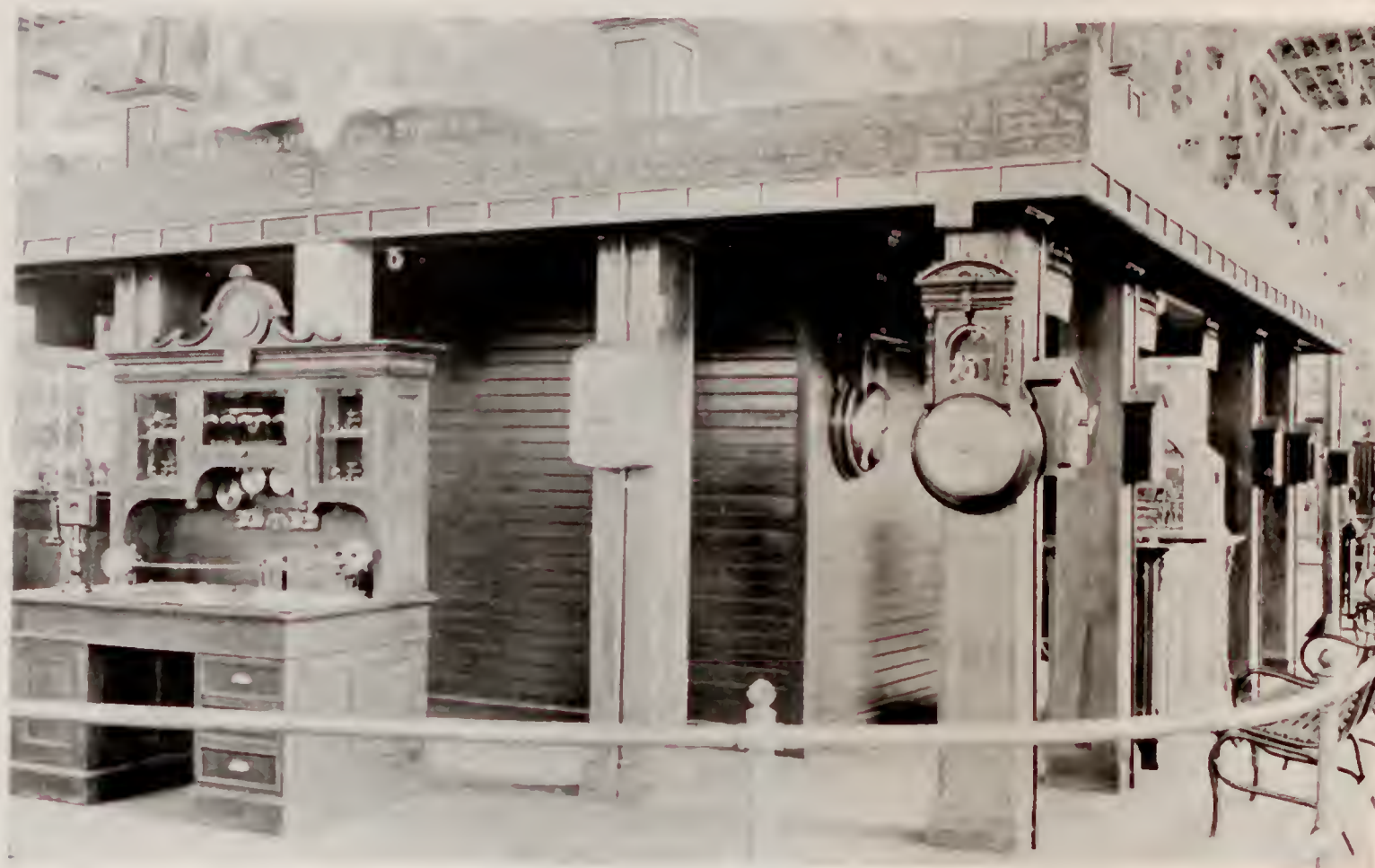


DYNAMO OF FORT WAYNE COMPANY

boots are polished by electric brushes. Here also is an electric incubator, with eggs in process of hatching. In one is a barely perceptible palpitation; another is heaving with suppressed activity; a third is partially opened, and from a fourth a pulp-like form has drawn itself partially into the world, and lays panting over its former prison walls, as if gathering strength to free itself. For hatching chickens by electricity, as compared with incubation by steam, the advantage is claimed that the needed temperature, a little over 100 degrees, can be

made absolutely uniform, while the machine requires but little attention. From the time the egg is placed in the incubator until the chicken comes from the shell is an average period of nineteen days. Two jars of Mason batteries are sufficient to furnish the heat and operate the thermostat, the latter never varying more than one half of a degree. One of the most interesting features of this exhibit was the sealing of a machine containing a dozen eggs, which remained untouched until the chicken emerged in due time, and in as lively condition as though fostered by the mother hen.

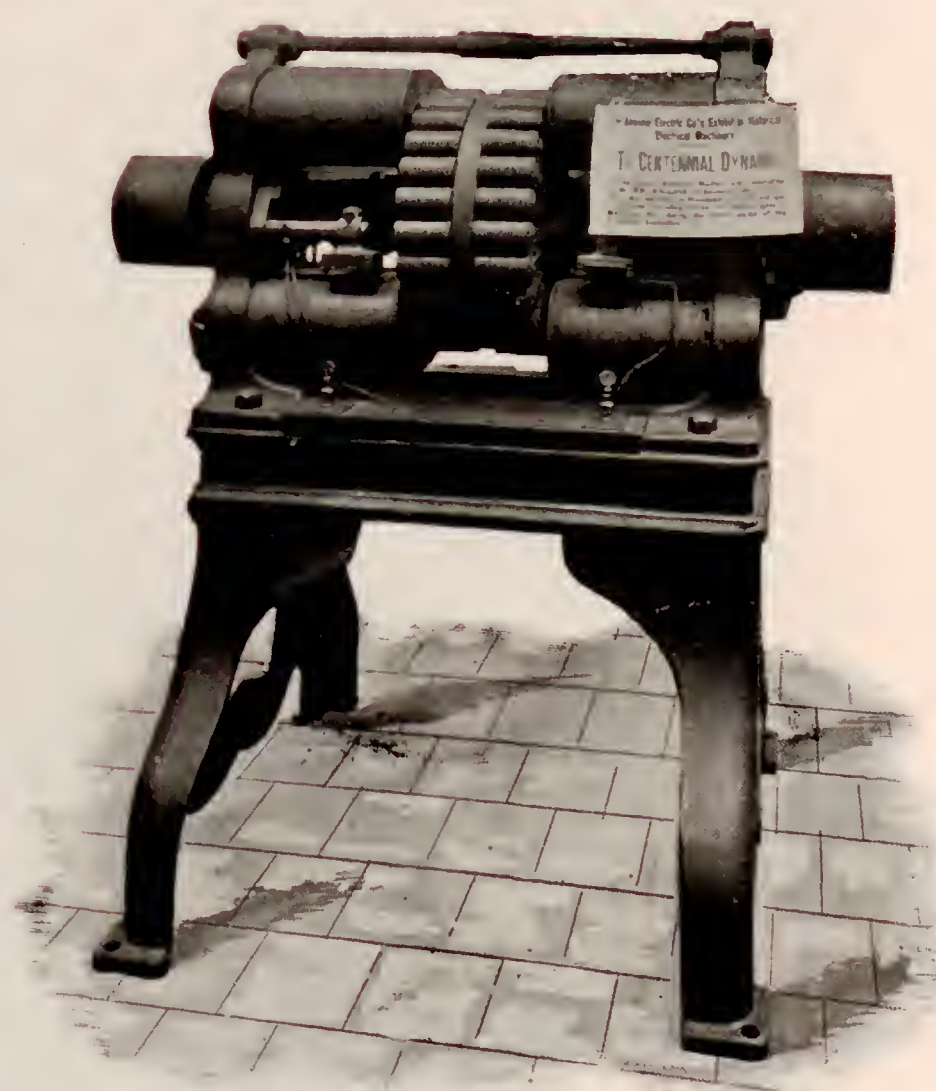
Three foreign powers have installed exhibits in the western galleries, Austria having chiefly



POLICE AND FIRE TELEGRAPH APPARATUS

a display of signal clocks and technical instruments, and Italy a small collection of china insulators contributed by a ceramic society of Milan. France has a large assortment of musical instruments, many of them overflow exhibits from the department of Liberal Arts, and having no relation to electricity. They consist of beautifully finished orchestral pieces, and include some fine specimens of inlaid work in wood and pearl, showing what may be done with pianos and other instruments in the way of cabinet decoration. There are several French inventions, some of which can be played as ordinary pianos, or by attaching them to other instruments. The music may be produced mechanically by turning a crank, or by electric self-acting machinery, and when the harmonies are combined the effect is often pleasing. More than fifty pianos are here, ranging in price from a few hundred to several thousand dollars. Of the new styles for which superiority is claimed, one has a frame of pure steel, and there is a French horn whose mouth is beaten from a solid piece of brass. In the gallery opposite this group is a row of tastefully furnished booths, the headquarters of the periodicals in the United States whose special field is electricity.

The principle that heat is generated by resistance to the electric current is illustrated in several portions of the building. Ovens and furnaces, and heating apparatus for railways, houses, factories, and public buildings, are exhibited on the ground floor, where also, as has been said, several companies show how welding may be accomplished by electricity. Other heating appliances are found in the galleries, a Wisconsin company which deals in novelties exhibiting a hair curler heated by electricity. But the most interesting application of this principle may be studied in the north gallery, where the housekeeper may see how her home can be comfortably warmed by electricity, and how her cooking may be done expeditiously and scientifically. The electric ovens are lined with wood and asbestos, which keep the heat within, and are supplied with doors of mica, and incandescent lamps and thermometers for ascertaining the temperature, and experimenting in all branches of cookery. As in other appliances, the electric current is governed by switches, the griddles, kettles, coffee-pots, tea-pots, flat-irons, and all other utensils having enamelled bottoms, in which are imbedded small copper wires. When the current is turned on and passes along the wires, the resistance offered by the enamel produces heat, which can be easily regulated and directed. For instance, in roasting beef, if one side of the piece is browning more rapidly than the other, instead of taking it out and turning it, the current is simply increased above or below as the case may require. The electric flat-irons weigh about eight



pounds, their upper portions being composed of non-conducting substances. Of all the companies which illustrate this phase of household economy, the Ansonia, of Chicago, has the most complete exhibit, presenting besides a display of cables, switches, batteries, motors, and a historical collection, including, as is claimed, the first of dynamos.

In the south gallery opposite are miscellaneous exhibits, one of which, by a Philadelphia manufacturer, is specially deserving of note. Upon an arched wall space, having a background of light blue, is a large

eccentric, composed entirely of switches made by the company, and upon a small display board are the various patterns representing the evolution of these appliances. The first is one of a hundred made by means of a hand drill, hammer, and chisel, the later varieties, composed of porcelain and English ivory china, being of elegant workmanship, and forming a striking contrast to the others. Among the exhibits in this portion of the building may be mentioned that of a New York house, which presents many fine specimens of photo-engraving and electrotyping, the display being of plates only; the large pavilion also adjoining containing several cases of finely wrought instruments.



GERMAN HISTORICAL COLLECTION

In the southeastern galleries is a pavilion surrounded by great coils of cable, and masses of a carbon-like substance, the latter the crude form of an insulating material known as kerite. The exhibitors manufacture insulating tapes and cables for underground and submarine use. A New York firm builds a cabin of wire ducts or conduits, and a Cleveland company erects a pillared structure composed of carbon, with pyramids and other forms within and around it. A manufactory of the same city occupies a considerable space with specimens of its handiwork in polished aluminum, brass, and nickel, arranged upon a large sample board which forms a background to the section. The specialty is a boiler alarm, which may be either in the form of a steam whistle or an electric gong, the danger signal being given when the water reaches the highest gauge, and the float raising the valve lever which releases the mechanism.

Safety appliances for the public are seen in the many devices of the telegraph systems which have been adopted by the fire and police departments of all large cities. A New York company which has furnished complete telephone and signal systems for many large cities exhibits its apparatus around a square pavilion, on whose cornices are the names of municipalities in which they are used. Near this is a booth from which float the national colors of Brazil, whose government manufactures its own telegraph and telephone instruments, as here represented. A large map is displayed locating the telegraph lines of the republic, and in book and pamphlet form is described the present condition of the system, and its development through native skill and ingenuity.

The exhibit of the Western Union Telegraph company is contained in a large plain pavilion, over whose main entrance are the words, "What hath God wrought," forming the first telegraphic message sent by Samuel Morse. In a case within is a photograph of this message, and the original Morse machine, side by side with the perfected instrument of 1893. Several portraits of the great inventor are hung upon the walls, with those of Cyrus W. Field, the father of the submarine telegraph system, and Thomas T. Eckert, who succeeded Norvin Green as president of the company. The pavilion also contains busts of Morse by the sculptor Greenough, and of Field, by Hartley. Several of Field's medals and other personal souvenirs are included in the collection.



GERMAN ELECTRIC APPARATUS, TELEPHONES, ETC

together with a reproduction of the *Great Eastern*, which laid the first cable, the model being loaned by one of her commanders, with various apparatus showing the workings of the system, now some quarter of a century old. On one of the maps are indicated the locations of the Western Union lines, which include 750,000 miles of wire; and on another is a model in relief of the bed of the Atlantic ocean, in which may be traced the systems operated by the Western Union, Anglo-American, Mackay-Bennett, and other submarine companies. This is the first profile chart of the kind, and was made by Captain Dutton, formerly of the cable ship *Faraday*, of which also a model may be seen in the company's pavilion. But perhaps the most attractive exhibit is the huge, rusty grapnel, with its five prongs, which in 1866 recovered the cable lost during the previous year in nearly 2,000 fathoms of water. The cable had parted 1,100 miles from Valentia; the attempt to recover it was abandoned for a time, and a new line constructed.

With the exception of the Western Union's exhibit, and a small display of dry batteries, Germany occupies all the northeastern galleries with her well arranged collections. One large department is devoted to the exposition of optical, surgical, electro-medical, and scientific apparatus. A curious exhibit is that of artificial eyes, some of them such exact imitations of nature that when examined from different positions their pupils appear to dilate or contract. Another collection illustrates the diseases peculiar to the human eye, and its normal condition as observed in the German, Slav, Roman, Gaul, Mongolian, and Negro. In this section are some finely executed anatomical models, respiratory apparatus, a large operating table, and a complete collection of surgical instruments, the last furnished by the purveyor to the Prussian armies. More picturesque than these groups is the exhibit made by the German postal service, consisting of model post and telegraph offices, as well as reproductions of many in operation, and articles which constitute the entire working outfit of the department. There are models of telegraph towers and of imperial postal cars; telegraph instruments of the Hughes type, upon which the operators play as if upon pianos; telephones of German make, cumbersome as compared with those of American manufacture, and maps showing the distribution of telegraph lines and post-offices throughout the empire. Telephones enter largely into the system developed in Germany, with some 80,000 in use. An important factor of the postal service is the pneumatic tube, and in this department is a miniature plant showing its operations. In another section are models of mail coaches, representative of early and modern times, while here is also illustrated the service of mounted messengers established along the river Spree in the fourteenth century.

The portion of the gallery which is above the eastern entrance to the building has been transformed into a court, approached by a broad stairway, the background and dais being festooned in crimson and gold, and bordered with evergreens, showing for its central object a bronze bust, mounted upon a massive pedestal, of the late Werner von Siemens, the famous German electrician and inventor. On either side are busts of Sæmmerring, announced as the inventor of the first galvanized telegraph, in 1809, and of Reis, inventor of the first telephone, in 1861. In the background also are medallions of Gauss and Weber, proclaimed as the joint inventors of the first electro-magnetic telegraph, operated in Göttingen in 1833. Fronting the busts and medallions, and arranged on the ledges of the enclosure, are the instruments, or their reproductions, designed to illustrate the historical development of the application of electricity in Germany. Here is the magnetic needle telegraph of Stöhrer, 1817, Reis' telephone apparatus, and a number of inventions by Siemens, including the dynamo of 1866, and his instruments for telegraphic printing and writing. There are also collections of ringing apparatus, electrical appliances and signals for railroads, lighting machines, samples of cables chronologically arranged, indicators, alarms, stone drills, mineral separators, and clocks, with other mechanisms showing that the Germans have won for themselves a leading rank in every department of electrical science and invention.

WORLD'S FAIR MISCELLANY.—The first general illumination of the Electricity building was on the evening of the 31st of May, and attracted many thousands of spectators. By eight o'clock the structure was one blaze of light, with myriads of incandescent lamps with revolving wheels displaying all the colors of the rainbow in ever-changing hues, and with unseen pens writing mysterious inscriptions on the walls in letters of fire. But in the very centre of the building was a huge shrouded figure which loomed ghost-like almost to a level with the rafters. Presently the chief of the department stepped forward; a moment later the shroud was withdrawn, and the Edison tower and the classic pavilion at its base stood revealed in all their cold, chaste beauty of outline. But for a few seconds only; the glare of search-lights focused upon them, causing their dark surface to shine with a dazzling radiance. Then the crystal bulb at the top burst into flame, flashing like a crown of diamonds; and finally the entire column was arrayed in robes of purple light like a pillar of fire. It was the very apotheosis of electricity, and by a thousand voices was shouted the name of him by whom these marvels had been wrought.

The illuminations of grounds and buildings begun in May, were continued throughout the term of the Fair, at first on alternate nights, and then every night in the week except Sunday nights. Occasionally the admissions after dark were larger than during the day; but as

the novelty wore off, and the average daily attendance gradually increased from 20,000 or 30,000 to 150,000, the proportion was not maintained. During one of the first illuminations, Machinery hall narrowly escaped destruction by fire. The shed that inclosed the machinery of the Westinghouse company's engines, by which at the moment power was furnished, was set ablaze through the burning out of one of the connections, caused by the pressure on the wires. Only through the promptitude and coolness of the men in charge a conflagration was averted which would have swept the building out of existence.

The light for the fountains with their prismatic hues and chameleon-like changes of color, was produced in a subterranean chamber, with which the fountains were connected. The lamps resembled the search-lights on board a man-of-war, except that for the lens used at sea was substituted a silver-lined parabolic reflector, from which the rays were shot upward for a distance of 150 feet. The lighting capacity of the lamps was controlled by a mechanism similar to clock-work, and could be intensified to a brilliancy of 350,000 candle-power. The water effects were also regulated in this mystic chamber, to the orifices of which a nozzle was attached, and through it the water projected in columns, jets, or sprays, with electric light playing upon them in varying hues from color screens beneath.

While electric light and power have been prominent factors at former expositions, they have never been so largely used and applied to so many purposes as at the Chicago Fair. At the Paris Exposition of 1879 there were some 1,500 incandescent lamps, and at the New Orleans Cotton Centennial in 1881 both arc and incandescent lamps were utilized to good effect. At the latter it was for the first time demonstrated that under this clear, white light, the delicate tints of flowers are almost as plainly visible as beneath the noon-day sun. At the Louisville Exhibition of 1883 there were 6,000 Edison lights, and at the one held in Paris in 1889, there were 1,000 arc and 9,000 incandescent lamps, both considered at the time a wonderful display of electric lighting. But in the buildings and grounds at Jackson park there were 6,000 arc and 120,000 incandescent lamps, the former each of 2,000 candle-power, while motive force of from 4,000 to 5,000 horse power was generated for purposes mentioned in the text.

In the Electrical building was installed apparatus of all descriptions excepting generators, which were located elsewhere. Power, for whatever purpose used, was furnished and transmitted, as I have said, from the station at Machinery hall, the plant being so constructed as to be complete in itself, and yet composed of numerous smaller plants.

The floor of the building was intended to sustain a minimum weight of 150 pounds to the square foot. By railroad derricks machinery of a weight not exceeding fifteen tons could be moved into position, and generating machinery up to a weight of twenty-two and a half tons could be handled by travelling cranes.

Neither for illumination nor other purposes were any of the wires placed above ground, all being fastened on insulators inclosed by subterraneous conduits. The arc lights scattered throughout the park were supported by pillars or masts twelve feet high, most of them 50 to 75 feet apart, and all arranged with a view to landscape effect.

Side by side with the Edison exhibit of incandescent lamps was a case containing many sections of fibrous vegetable growths, used by the inventor in his search for the substance best fitted for a lamp filament. The selection finally made was that of a Japanese bamboo, which is now extensively cultivated on special plantations. It is said that in arriving at this result, Edison travelled many thousands of miles, and expended at least \$200,000.

Near the pavilion of the Commercial Cable company a Fort Wayne establishment had an exhibit which overtopped all others in the galleries. It consisted of iron towers and poles such as are used in railroad construction, and for street lighting.

Nikola Tesla, the so-called wizard of physics, whose current motors are mentioned in connection with the Westinghouse company's exhibits, is one of the youngest of our great electrical scientists, and yet a man of world-wide repute. His fame rests mainly on his multiphase alternating motors, whereby are produced high potential currents of remarkable frequency. On the 25th of August he lectured in the assembly room of Agricultural hall before an audience consisting largely of electrical engineers and scientists. During his discourse he exhibited a motor or oscillator driven by compressed air, which made 80 vibrations to the second, stating that he had made others capable of several thousand vibrations to the second. To this he attached a dynamo small enough to be slipped into the pocket, and yet of considerable power.

Elsewhere is noticed the exhibit by the seismological laboratory of the Imperial university of Japan. As stated, the first instrument to record motions of the earth was invented by a Japanese more than seventeen and a half centuries ago, but it was not until 1875 that an observatory was built for the purpose in Tokio. The first instrument used was the one invented by Palmieri, the director of the observatory on Mount Vesuvius; but since 1884 this has been replaced by the Milne instrument, which records horizontal and vertical motions, with the time and duration of shocks. This year also marks the commencement of a system of investigation covering the entire empire, the observatory publishing guides for noting and reporting seismic phenomena, with or without the aid of instruments. These were distributed among hundreds of officials and others whose reports were transmitted free by the post-office. From these maps have been made showing the disturbed areas of the 3,800 earthquakes which have occurred throughout the empire from 1885 to 1890, as well as their relative intensity. Observations since that year have greatly added to previous records, especially those of the great earthquake of October 28, 1891. In this the centre of disturbance was almost in the middle of the main island, though with shocks more or less severe almost throughout the empire. Within a comparatively small radius over 7,000 people were killed, and 142,000 houses totally destroyed. The ground was rent and cracked, permanently depressed or upheaved, thousands of landships were produced, water and sand were ejected, multitudes of embankments shattered, railway lines twisted, and bridges hurled into rivers, which, with other havoc, was graphically depicted in the Japanese section of the Electricity building.

The enormous switchboard exhibited by the Brush Electric company was sold through its agents in Yokohama for the use of a power station now being erected in Manila, Philippine Islands, the company also furnishing several dynamos.





EAST ENTRANCE, HORTICULTURAL BUILDING



CHAPTER THE FIFTEENTH

HORTICULTURE AND FORESTRY



TO him who reads aright the lessons of the Fair, one of the most significant is that the nations of the world are coming nearer together than ever before, and among its highest aims is to hasten this process of unification. Through the activities of man, even the vegetable kingdom is becoming, as it were, a universal brotherhood, and intelligently viewed, the Horticultural department not only affords an opportunity for comparing the products and methods of foreign lands with those of the United States, but offers a panoramic view of the entire vegetable world, its scenes of course shifting with the changing seasons, and though here described in the present tense, displaying innumerable phases such as neither pen nor picture can delineate.

Under the general term horticulture are included, for the purposes of the Exposition, viticulture, pomology, and floriculture, wines, fruits, and flowers being displayed in all stages of development. By means of photographs, books, and appliances are illustrated the modern management of vineyards, and methods of manufacture, bottling, packing, and shipping. In the pomological sections are fresh, dried, preserved, and canned fruits. In a miscellaneous department are nuts, jellies, vinegars, ciders, etc. Here also are mills and presses, and the latest inventions for drying and preserving fruit. Floriculture appears, decked in robes of beauty, gigantic palms and tropical plants forming a background to delicate ferns and flowers. Another subdivision consists of floral designs and flower stands, with ornamental plants and grasses, and literature relating to their growth and training. Vegetables and seeds, with all the best appliances for ornamental and landscape gardening, are also grouped under the general heading of horticulture.

Fronting 1,000 feet on the lagoon, and with an extreme width of 250 feet, the Horticultural building covers an area of five and three-quarter acres, and with its greenhouses, and other adjuncts, of eleven acres. But as to the size of this structure, and of the other principal structures of the Fair, a better idea may be conveyed by stating that the former, though one of the smallest of the group, is almost as large as the Crystal Palace, in which has been partially preserved the home of the London Exhibition of





HORTICULTURAL BUILDING, FROM WOODED ISLAND

1851, and that it contains some 90,000 feet more of exhibiting space than all the three edifices used for similar purposes at the Philadelphia, New Orleans, and the last of the Paris expositions.

While intended mainly as a spacious conservatory, in structural design the Horticultural hall by no means suffers from comparison with its more ambitious neighbors. In a word its plan may be stated as including a central pavilion, more than 200 feet square, surmounted by a crystal dome, and connected with smaller pavilions at either end by two longitudinal series of galleries, glass roofed, from 50 to 70 feet in width, and inclosing garden courts, each somewhat more than half an acre in extent. A feature of the edifice is its decoration in alto and basso relievo, the frieze



MAIN ENTRANCE



1 AUSTRALIAN PLANTS
2 AUSTRALIAN TREE FERN, 27 FEET HIGH

3 CACTUS FROM U. S. BOTANICAL GARDENS WASHINGTON D C

4 STAG HORN FERN
5 SOUTH SEA ISLAND TREE FERN



EXIT FROM CRYSTAL CAVE

plant life and floral decoration, presents one of the most striking kaleidoscopic vistas contained in this city of wonderland. Rising nearly to the summit of the dome is a miniature mountain, gigantic ferns, and palms, creepers, and flowers of brilliant hue, giving to the scene a rich tropical aspect. Above are great hanging baskets, and at the base, around a border of green fringed with blossoms, the sago palm, Abyssinian banana, screw pine, and other striking forms of tropical vegetation. From the gallery also may be seen to excellent advantage the gigantic forest growths of Australia towering roofward like the pillars of a temple, and in a conservatory opposite the softer floral beauties of the United States.

If less picturesque, the central galleries furnish exhibits no less entertaining than those on the ground floor. Among them is a large collection of views of the botanic gardens in Sydney, New South Wales, which have sent so many of their treasures to the Fair. The gardens of the Imperial university at Tokio are also well represented by photographs, and another interesting feature is the artificial fruits of the Yokohama Gardeners' association. Photographs of famous gardens and nurseries in the United States, diagrams of public parks in Colorado, Oregon, and elsewhere, with the models of villa gardens which line other sections of the wall, indicate that a principal object of this gallery exhibit is to illustrate the latest methods of landscape gardening. Then there are richly stocked herbaria, especially from the western states, and thousands of pressed plants and flowers tastefully displayed in revolving frames. One of the most remarkable collections was made by a woman of Colorado, who for

which is six feet in height, and extends along three of its sides, displaying the handiwork of a cunning artificer.

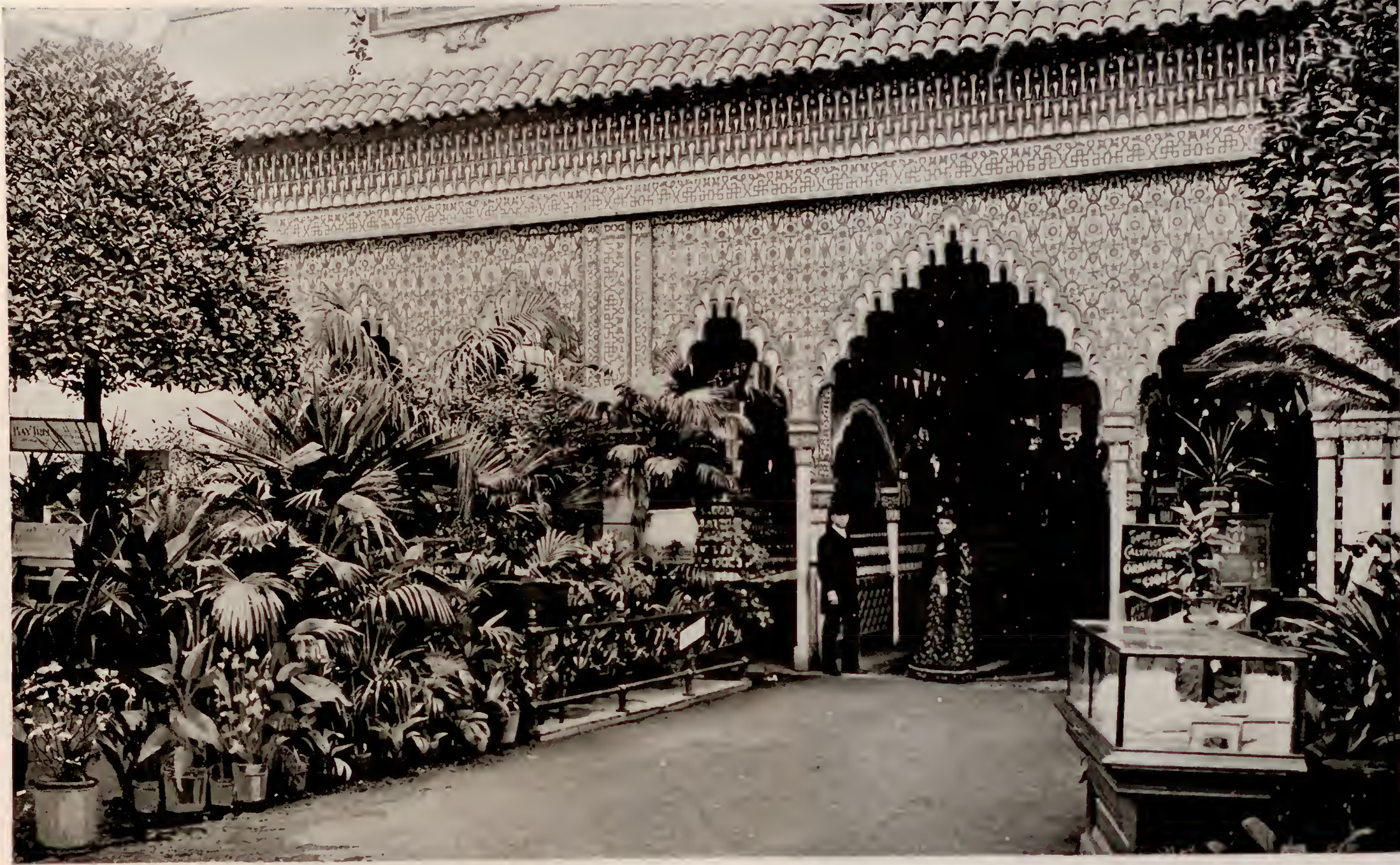
As to interior effect the arrangement of the building is admirable, and if exception has been taken to the depression of the dome, whose height of 115 feet is barely two-thirds of its diameter, it will be observed that the long, low façades of the conservatory forbid such towering aspirations as are not inappropriate to the more substantial structures of the Exposition. Moreover this seeming disproportion is relieved by the curved glass roofs of the galleries on either side, by the lower domes at its base, and by the crown with which it is surmounted.

By the architects, Jenney and Mundie of Chicago, was adopted in their decorative plan the style of the Venetian renaissance, while the walls of the front galleries and those which surround the side pavilions are divided by pilasters of the Ionic order into windowed bays, thus reducing the wall surface to the smallest possible area. At the principal entrance, from the terrace fronting on the lagoon, is a triumphal arch, the vestibule of which is profusely decorated with statuary, and on either side of the main pavilion are groups of sculpture fashioned by Lorado Taft, one representing the awakening of the flowers, and the other their repose at spring and autumn tide. These are among the most chaste and expressive of all the artistic embellishments of the Exposition buildings, and standing forth in bold relief under the vault of the central dome, form the complement of the architectural design.

From the promenade gallery encircling the dome, the hall itself, with its wealth of



WEST SECTION OF FERN MOUNTAIN



LOOKING INTO THE VITICULTURAL HALL

months climbed its lofty ranges, and travelled over foothills and plains, contributing in no less than a thousand varieties an almost complete display of its flora. The mouse-fungus, with rust, blight, mildew, rot, and all the pests and plagues of the vegetable kingdom are here exemplified, and there are odd conceits for fences, rustic vases, and other garden ornaments, with collections of dried grasses, and preserved flowers made into wreaths, baskets, and other designs.

Descending to the base of the miniature mountain the visitor finds in this neighborhood, almost side by side with tropical exhibits, special displays from New York, New Jersey, and Pennsylvania, the leading floricultural states. Palms from Australia and the Americas lift their graceful fronds, and here are represented the choicest treasures from the conservatories of millionaires, such men as the late Jay Gould, A. J. Drexel, George W. Child, and Erastus Corning. Here also an Indiana century plant first displayed its yellow flowers, with others of its kind on exposition, all under the great dome, and in the adjoining conservatory, while France shows the rich masses of rhododendrons in which she takes a national pride.

A broad avenue passes around the miniature mountain, and along its outer edge New York and Pennsylvania again present their floral displays. In one corner is an elegant booth in which are plants, hanging baskets, cut flowers, and floral ornaments and designs—a contribution from the empire state. A few steps further is a collection of New Jersey snap-dragons, and other insect devouring plants. In this locality is also a collection of plants from



UNDER THE DOME



FLORAL DEVICE IN ROTUNDA



HORTICULTURAL BUILDING, FROM SOUTHEAST CORNER



the stalactites and crystals which form the cathedral chimes, the bridal chamber, and other well known features, all represented with remarkable accuracy.

Entering the southern conservatory from the rotunda, we find ourselves in the midst of a profuse display of orchids and ferns, presented mainly by the New Jersey firm of Pitcher and Manda, whose exhibits are a prominent feature in the floricultural department. The orchid groups, which include private collections from Albany, Philadelphia, Jersey City, and other localities, are in truth one of the leading attractions of Horticultural hall, but as a considerable proportion of the 4,000 or 5,000 existing species, with all their varied forms, their brilliant hues, and delicate odors, is here on exposition, a detailed description would be obviously out of place.

Further to the south the women of Texas have their exhibit, those of Galveston contributing Cape jasmines and sweet bay trees, while Laredo sends a large bed of cacti, both of which attract many visitors to this section. Missouri's display adjoins a grove of palms near the centre of the conservatory, and includes many rare and beautiful plants from the botanic gardens of St Louis. Here also Pennsylvania has another large exhibit; Massachusetts occupies a limited space, and other states have scattering contributions. In the Illinois display are fine specimens of the bay laurel, and Indiana has a flourishing group of begonias. In this conservatory of the states is also a bed of cacti representing the botanic gardens at the national capital.

Corresponding to these exhibits south of the central court, is one in the northern section showing the floricultural collections of foreign lands. In the centre are the huge tree ferns from Australia, some of them forty feet high, with other plants of that species whose leaves are in many fanciful shapes. Here also are the staghorn ferns, from seven to eight feet in diameter, and as many in height, clinging to trunks of teak-wood trees, whose vitality has been exhausted in their embrace. At their feet are more delicate ferns with mosses, grasses, and many of the creepers which grow in

the executive mansion, at Washington, the most striking of which is the so-called crown of thorns.

Forming a portion of the New York display is a large model of the national capitol, constructed of Canadian thistles, and near this are several large beds of Pennsylvania cacti, one of them alone containing three hundred varieties. Stepping into a small chamber in the form of a cave beneath the mountain, we find here a miniature reproduction of the famous Black Hills cave in South Dakota, with



EXHIBIT FROM THE NATIONAL CAPITOL

profusion amid Australian forests. In the Canadian exhibit adjacent, Ontario has many varieties of palms and ferns, eighty in number, and most of them from the horticultural gardens at Toronto. Among the former, one of the most remarkable is known as the Sabal Anderson description. Of other trees and plants, including cacti, flowering shrubs, and ornamental leaf plants, there is also a large collection.

Further toward the north is the Japanese garden, arranged in the simple, artistic fashion for which that people is famous. A rustic bridge spans a small pond, filled with gold-fish, and fringed with water-lilies and ornamental plants. Near by are the quaintest of urns and vases, containing orchids and other floral treasures, with plants of all kinds, miniature hills, among which are clusters of sago-palms and models of animal life, with a rough stone wall covered with native evergreens, morning-glories, and creepers, and with colored sands arranged in geometrical figures, all forming a picture in which is substantially reproduced a portion of the Japanese imperial garden.

On the opposite side of the conservatory are beds of cacti from Mexico, arranged as single specimens or in conglomerate masses, and ranging in size from that of an apple to a bushel basket. Some appear like petrified porcupines, or spiny creatures of the deep; others are thin and starved, and still others seem as if they had lived upon the fat of the land.



ONTARIO PALMS



BED OF TEXAS CACTI

This exhibit, as well as the other cactus beds scattered throughout the department, is specially typical of America. One of the most prolific of the forty or fifty species is the elephant tooth cactus, bearing a flower like a rose or lilac, red or crimson fruit succeeding the blossom. The fig cactus is similar in shape to the fruit from which it is named, its pale yellow flowers giving place to an edible product resembling the gooseberry, which serves as food for the cochineal insect, and at times for the inhabitants of Mexico and Central America.

Beyond the cacti bloom the cannas and begonias of Great Britain, and the azaleas of Belgium and Germany. Especially noticeable is the German display, neatly and artistically grouped around a central fountain. At the upper end of the conservatory, beyond the banners of Australia, and the white and red flags of Japan, are the tropical plants of Trinidad, and above her exhibit rests, on a large pedestal, the golden lion of Britain.

Between the main hall, the pavilions, and their connecting curtains, are two spacious courts, the one to the south occupied by large basins or tanks filled with aquatic plants. In the northern court is a vault-like pavilion, 189 by 135 feet, constructed of iron, and stocked with South German wines. The façade and roof are adorned with appropriate statuary, and the walls

are covered with paintings illustrating various scenes in the wine producing districts of the German empire. The vine-clad banks of the Rhine and the Necker, the famous district of Moselle, the wine industries of Baden and Alsace-Lorraine, are all depicted in graphic art, while plaster casts and a sparkling array of wines in bottles complete this display from the fatherland. The historic monument of Germania and the Rhenish castle of Ehrenfels are reproduced, as models, in the entrance hall of this structure. The exhibits of wine are arranged according to locality, each specimen being labelled, and grouped with reference to the vineyard, village, or district where it was produced.

Apart from this the collection of wines is in the southern extremity of Horticultural hall, where Spain, France, and Germany, California, Australia, and other countries vie with each other in the quality and artistic grouping of their exhibits. Spanish ports and sherries, fashioned into pyramids, are displayed in a gaudy pavilion, or series of arched, open structures. Sometimes the towers are formed of solid bottles; again the base is made of casks and barrels, with rows of bottles let into their sides. Within these glistening piles are real sherry wines from the Xerez district, the strong, dark vintages of Valencia, and lighter, sweeter grades from the Spanish sierras, from whose vineyards also come the grapes which are made into Malaga raisins.

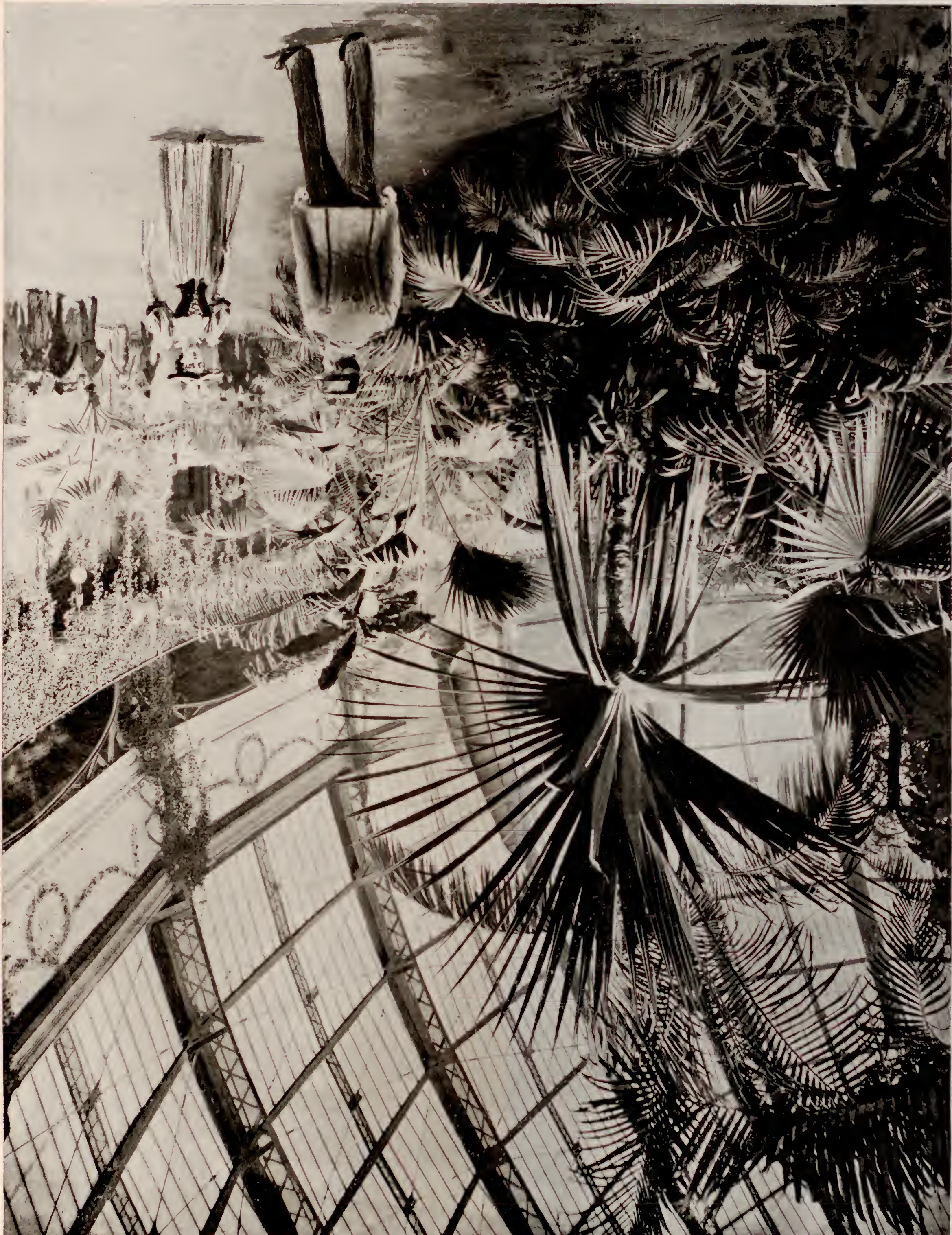
A large portion of the French collection consists of sparkling champagnes, including a tastefully arranged exhibit from Rheims, its ancient home, and, with Epernay, still its most important centre. An immense bottle reaching nearly to the ceiling of the hall may be considered as a monument to the Benedictine monk, who, two centuries ago, gathered the wines from the districts surrounding Rheims, and by mixing them made the first champagne that history records. The white wines of the Sauterne and Gironde districts, the rosy Medocs, clarets, and Burgundies, and a dozen other brands appear in various devices, as contributions from exhibitors in Bordeaux, Marseilles, Paris, and Nancy. Cordials and mineral waters are also in plentiful supply, and models of machinery, as well as of vineyards in the famous districts of Medoc and Gironde, serve to break the monotony of endless rows of bottles. In photographs and charts are shown all the insects which injure the vine, and their mode of attacking it, the king of them all, the phylloxera, receiving the lion's share of attention.

The German display in the southern section of the hall is a large and massive exhibit, of more general character than the one already mentioned. Worthy of note are the sweet, mellow wines of Rhenish Bavaria, the red wines of the Ahr, and the stronger products of vineyards planted on the banks of the Rhine; but most of the principal wine-producing districts of the empire, with their output of nearly 100,000,000 gallons a year, are here represented. In this collection also is a large assortment of beers and brandies, of cider, temperance, and



AUSTRALIAN TREE FERNS

FROM THE GOULD CONSERVATORY, HORTICULTURAL HALL





MEXICAN EXHIBIT OF CACTI

ducers of Sonoma county, prominent among whom is an Italian-Swiss colony. In a separate structure are also represented the great vineyards and cellars of the late Leland Stanford, at Vina, in the Sacramento valley, its court opening through an arched entrance way into a spacious vault, lined on either side with barrels of huge proportions. In pictures are also reproduced these famous



JAPANESE DWARF CEDAR

vineyards and wine cellars, together with the bonded warehouse in which at times is stored \$1,000,000 worth of brandy. From Napa, Sonoma, Santa Clara, Alameda, and other counties there are smaller exhibits, all contributing of their best toward a combined display representing one of the foremost of Californian industries.

Not the least valuable exhibit is that of the State Viticultural commission, consisting of

all other beverages that find favor in the fatherland.

Adjacent to this, and in the southwestern corner of the viticultural pavilion, is the display of California wines, by far the largest and most attractive of our domestic collections, its effect increased by the skilful grouping of the exhibits and the ingenious structure which contains them. A red cedar pavilion, 40 feet in height, is fashioned so as to resemble one of her giant trees, the main entrance having the appearance of an archway built of rocks, while around the trunk are various figures emblematic of viticulture. The goddess of the vine is crowned with a tiara of vines and grapes, and toward her an Indian girl is approaching with fruit-laden basket. A padre, with spade in hand, represents an early stage of the industry, and a huge grizzly bear is a character in Californian history which requires no introduction. From the gallery a staircase leads into the pavilion, so that the visitor may pass either from the ground or upper floor to the exhibits within.

Passing through the main doorway, we pause for a moment before a large panoramic view of the Golden Gate and the harbor of which it is the portal. Then turning to the exhibits, we notice first of all the collective display of several of the largest vintners and viticulturists, whose cellars in San Francisco and elsewhere contain larger stores of wine than those which Hannibal wasted, when, on his march toward Rome, he bathed his horses' feet in the choicest vintages of Italy. Of some of the vineyards, covering their thousands of acres, there are paintings by local artists, with tablets and appropriate mottoes. A favorite corner of the viticultural hall is in the shape of a redwood tank, garlanded with vines, and forming, with its contents, the exhibit of several large pro-



JAPANESE EXHIBIT



GERMAN FLORICULTURAL DISPLAY

of California have assumed any large proportions, or indeed that here were known either the art of producing marketable wines or the grapes best adapted to the purpose. As late as 1860 the bulk of her wines was made of mission grapes, such as the Franciscan fathers transplanted from Mexico, and from which was extracted a light colored beverage, heavy, and rank of flavor. Later, many foreign varieties were introduced, largely through the efforts of the commission; and presently wine-making was based on scientific methods, and became a fairly profitable industry. Then came over-production, for as yet the demand was only for local consumption; but gradually California wines gained a foothold in eastern and European countries, especially in France, where they are doctored and often returned in adulterated forms, to be sold under foreign labels at from three to five-fold their original cost. In 1881 more than 3,000,000 gallons were shipped to the Atlantic states; in 1890 more than 12,000,000 gallons were forwarded by rail or sea, and of the present output, averaging some 20,000,000 gallons a year of wine and 1,500,000 of brandy, or more than one-half the entire yield of the United States, at least 70 per cent is shipped to eastern and foreign markets.



ELEPHANT EARS LILIES

Aside from California, the most elaborate of domestic collections are from New York, Ohio, and Missouri. The dry wines, champagnes, and brandies of the empire state are especially noticeable; exhibitors from Ohio and the region bordering on Lake Erie group their specimens in and around an elaborate column of bottles, and two of the most prominent wine companies of Missouri show their samples in neat and tasteful pavilions. New Jersey is also well represented, and among her participants is one of the oldest of German wine makers in the United States. From Manassas, Virginia, comes a specimen of her vintages, and there is wine from a vineyard planted on the battle-field of Bull Run.

Near the French section are towers and pyramids of bottles filled with the red and white wines of New South Wales. Photographs of her vineyards show that they are large and thrifty; and here also the information is conveyed that among the more important of native red wines are Burgundy, claret, and hermitage; of sweet wines, Muscat, port, and sherry; of white wines, hock, Madeira-dry, Shiraz, and Tokay. Australian vintages, it may here be observed, are gradually finding favor in European markets, with exports to England alone of 200,000 or 300,000 gallons a year. Already the tentative stage has been passed, and many varieties will bear comparison with the lighter wines of French production, while for domestic use they have almost superseded imported brands.

Across the aisle from the exhibit of New South Wales are the light wines of Austria-Hungary; and here also Russia displays the products of her Caspian and Caucasian vineyards. In a far corner of the hall are

practical and reliable descriptions of viticulture as pursued in California. On either side of its space are growing vines, above which are photographs of grape clusters, showing the best varieties for the production of wines, brandies, and raisins. Famous vineyards are also depicted, and in a colored series of state and county maps are shown the areas planted in many varieties of grapes.

From a few hundred acres of vineyard planted by the padres and their neophytes during the pastoral days of California, the area under cultivation increased to nearly 200,000 acres in 1892, with more than 150,000,000 vines, yielding, in full maturity, an average of three or four tons to the acre, a ton of grapes producing about 120 gallons of wine. It is not until recent years that the viticultural interests

the wines of New Mexico, North Carolina, and Japan, in small but tasteful groups. On the pavilion of North Carolina is an inscription which claims that her territory is the home of the grape; thus recalling the stories told by the discoverers of the Atlantic coast as to the profusion of wild grapes along Carolina shores. The Japanese booth has corner posts of bamboo poles, and above it is the national flag, whose device is a red ball upon a white background. The names upon the bottles are strange, and we wonder, for instance, what such a wine as selijyunbudosyu can be, hoping that the beverage is more palatable than its name suggests.



INTERIOR OF THE GERMAN WINE CELLAR

consisting mainly of ornamental structures, composed of casks and bottles, the centre-piece resembling a large flowering bush. Near the base of the structures are many large diplomas presented to Italian wine-makers at former expositions. Of the wines themselves the choicest are those from vineyards planted on the slopes of Mount Vesuvius. The wines and brandies of Greece are displayed in a white pavilion, the roof of which is supported by Corinthian pillars, and at the further end of this gallery are exhibits of California raisins, one in the form of a pyramid of glass cases from Escondido, and others neatly arranged by Fresno dealers and packers.



PART OF GERMAN WINE EXHIBIT

The pomological exhibits are mainly grouped along the curtains of Horticultural hall, and largely consist of the green products of the United States, and other lands. Shipping their fruits in compartments cooled by refrigeration, such distant regions as the Cape and Australian colonies forwarded their more hardy species in fresh condition, while grapes and orchard fruits of the season of 1892 were preserved in cold storage for exhibition, not only in our own but in foreign countries. Thus France has sent us several hundred varieties of deciduous fruits, her display of pears being the largest, and one of the best on exposition. Russia has forwarded a collection gathered from every region of the empire, even from the frozen plains of Siberia,

while from the tropics came varieties that could not elsewhere be seen. From northern Africa came a consignment, and New South Wales installed

In the gallery of the viticultural section are the government exhibits of Italy, Greece, and Portugal, with miscellaneous assortments from France and Spain. The latter include the cordials of a Spanish manufacturer, of which, it is said, the Infanta loves to partake. On the opposite side of the gallery is the Portuguese collection, contained in a pavilion of which one of the arches spans the stairway leading to the upper floor. Vines are trellised over the wood-work, and the national flag and royal coat of arms are grouped over the principal arch. Within are said to be the genuine wines of the Oporto district. Italy occupies the western end of the viticultural gallery, her exhibit



IN THE FRENCH SECTION

the first shipment of fresh fruit sent from Australia to the United States.

About the middle of March several barrels of apples, a bushel of pears, and a crate of grapes were placed on board a sailing vessel bound from Melbourne to San Francisco, and then forwarded by rail to Chicago, where they were installed in good condition. Other shipments of fruit were made from Australia under more favorable conditions; and by Atlantic steamers, with their cold-storage compartments, oranges, lemons, figs, and other fruits were brought from Naples and elsewhere in southern Europe. Thus the pomological department at Jackson park represents the conditions and products of the principal fruit-growing regions of the world. Several countries which could not furnish a complete exhibit substituted wax and plaster models, Germany excelling all others in this respect, with imitations so perfect that it is almost impossible to detect them. In drawings and paintings are also placed before the visitor the native fruits of several lands.

A liberal but divided space in the northwestern section of the hall is devoted to the citrus display of California, one that is in all respects worthy of the golden state, collected and grouped with the utmost care, and renewed as

occasion requires, the waste of fruit from decay and damage amounting, in this and other exhibits, to hundreds of pounds a day. On tables, in piles, in pyramids, and in more complex forms, one of them reproducing the orthodox liberty bell, are oranges and lemons of all varieties, gathered from many portions of the state, from San Diego county, adjoining the Mexican border, almost to the boundary line of Oregon. Among the scores of specimens are the best that Riverside and other citrus belts could send, including Washington and other navels, Mediterranean sweets, St Michaels, and Malta bloods; while of lemons there are the Sicilian, Lisbon, Bonnie Brae, and Eureka.

At the opposite end of the section the citrus belt of southern California is represented by a tower of oranges, thirty feet high, its base of navels and other of the larger species, above which are the smaller varieties, its top surmounted by an eagle, and encircled with rows

of lemons, fashioned in the shape of a cornice. In the open court beyond are orange and lemon groves in miniature, with other exhibits illustrating California methods and products by practical results. Add to this the peaches, nectarines, and apricots; the cherries, and plums; the apples, pears, quinces, grapes, figs, olives, and berries which California had to show during the season of their fruitage, and no wonder that the display from the golden state was to the majority of exposition sight-seers almost in the nature of a revelation.

Fruit-growing, as I have said, is every year assuming larger proportions in southern and central California, where, from the foothills of the sierra to the shores of the ocean, there are large areas adapted to this industry. Many thousands of acres, before devoted



WINE EXHIBIT, CALIFORNIA



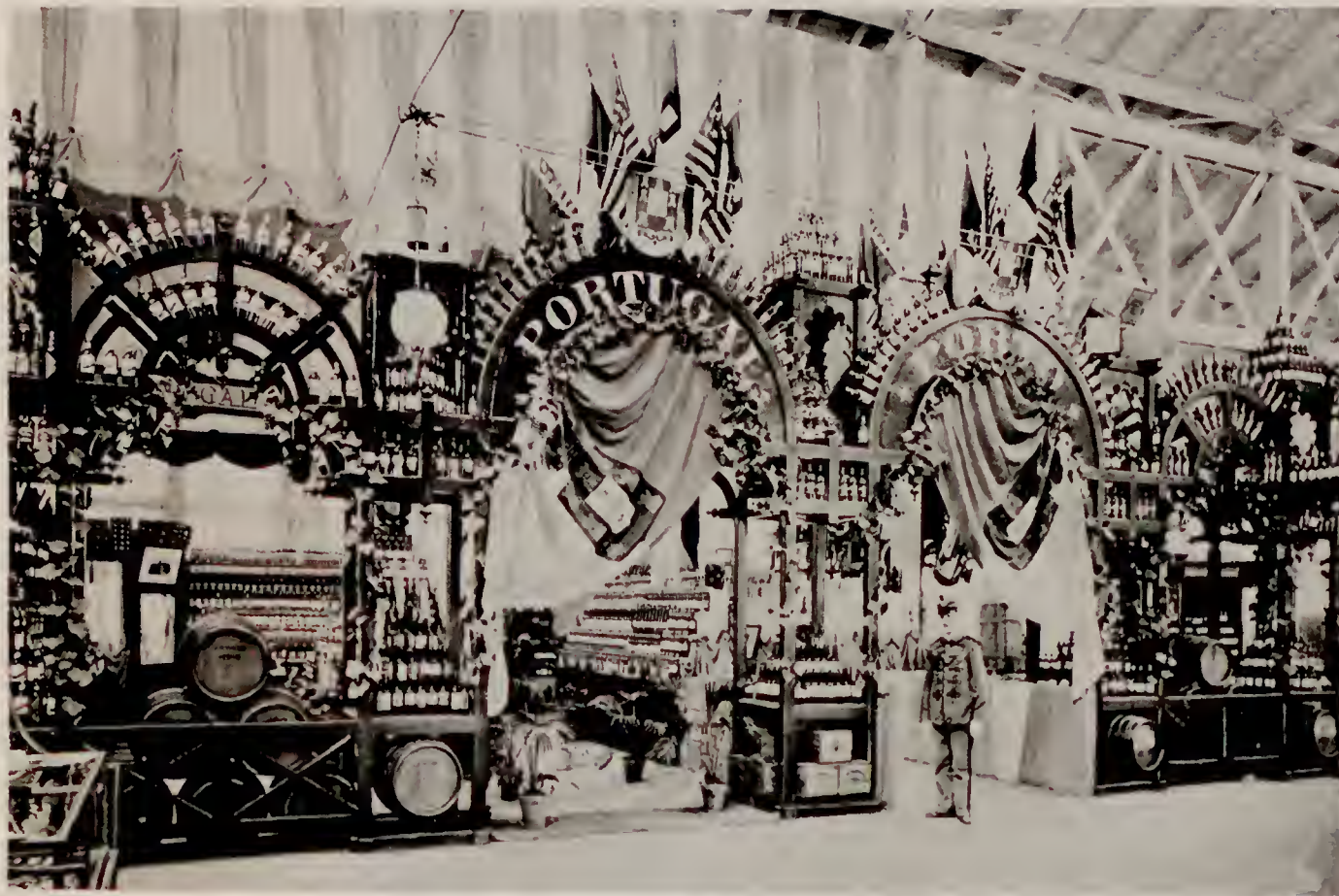
REDWOOD TANK



CALIFORNIA'S TREE PAVILION



WINES OF ITALY



WINES OF PORTUGAL

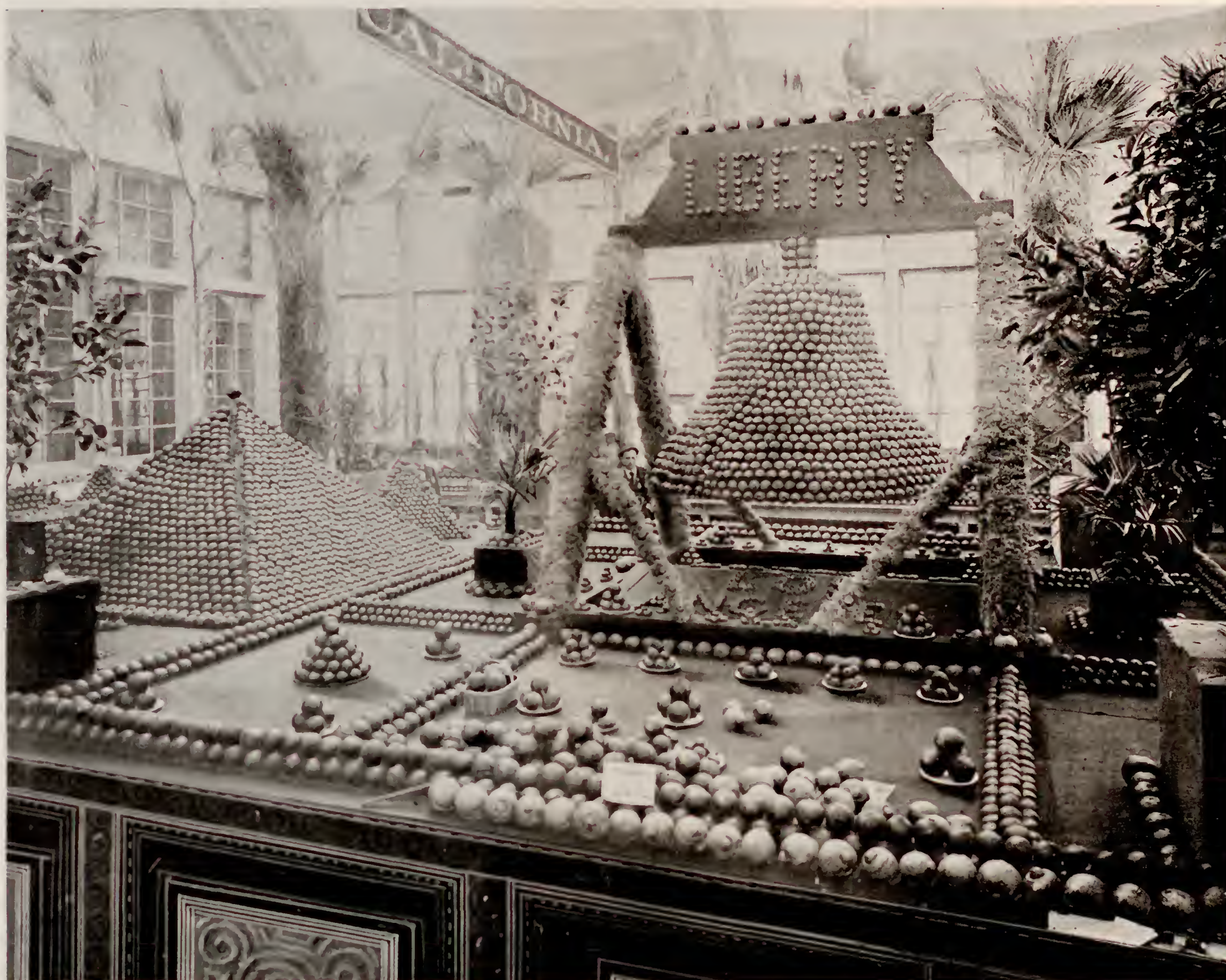
tons of fruit, in whatever form, were forwarded to eastern points; in 1880 the total did not exceed 3,000 tons; for 1890 shipments of fresh fruit amounted to 52,500 tons, and of dried fruit, 33,000 tons. For the three years ending with 1889 the trade with New York alone increased in more than ten-fold ratio; in Chicago almost as much, and in either city California fruits were hawked around their streets, and were for sale at moderate prices in hundreds of stores and booths. Said the *New York Sun*: "The products of Pacific slope orchards and vineyards are now competing with our own fruit products, and beating them out of their boots, so to speak, in spite of the 3,000 miles of disadvantage under which Californians labor in comparison with local growers."

Between the two divisions of the Californian exhibits are scores of long tables covered with groups of apples, including the russet, Ben Davis, Northern Spy, and their kindred, from all the states. New York and Michigan occupy the central spaces, flanked by Wisconsin and New Jersey. "York state" apples have ever been favorites, even with western people, and assuredly her 110 varieties displayed in Horticultural hall will not dispel the charm, especially her Newton pippins and Hudson river apples. Of excellent quality also are her grapes, pears, strawberries, and other fruits, smaller than western descriptions, but, as is claimed, superior as to flavor, texture, and durability, the rich western soil favoring rapid growth and bulk at the expense of finer qualities. Minnesota and Illinois are grouped beyond New York, the latter occupying a tasteful pavilion, divided into sections, in which are displayed her berries arranged according to locality. Iowa also maintains her reputation as a fruit-growing region. Tokay and other grapes, and the large orange cling peaches of the western states are also on exposition, some of the latter almost as large as summer squashes, preserved in liquids, and displayed in glass jars.



LOOKING INTO THE VITICULTURAL HALL

The strongest feature in Missouri's exhibit was her choice collections of peaches, berries, and apples, the famous olden fruit farm of Howell county, and other orchards of the Ozark mountain country sending frequent consignments of peaches in season, while, earlier during the term of the Fair, southern Missouri sent strawberries of wonderful size and flavor. In her exhibition of fresh fruits, replenished and varied throughout the season, Missouri was a competitor with such states as Delaware, New York, New Jersey, Pennsylvania, Ohio, Michigan, Illinois, Wisconsin, Minnesota, and Iowa. There were also 1,000 glass jars of all sizes and shapes, filled with nearly all the fruits, berries, and vegetables of the temperate zone, preserved in antiseptic fluids, so that for several years some of them have almost retained their natural appearance. Arkansas shows many



LIBERTY BELL IN CALIFORNIA SECTION

specimens of apples, pears, peaches, plums, and small fruits, all of excellent quality, and especially her apples, whose flavor and staying qualities are strongly commended.

A theme of almost universal comment are the exhibits of the far western states, apart from that of California. From Colorado come berries as bright and fresh as her own mountain air, with fruits preserved in alcohol, and wax models, taken in fac-simile during the autumn of 1892, of more than 600 specimens of apples, peaches, pears, quinces, and melons. Idaho sends her preserved grapes, prunes, egg-plant, radishes, and other fruits and vegetables, some of which were raised at an elevation of six thousand feet above sea level. Oregon, Washington, and Montana have thousands of green and preserved specimens of apples, apricots, cherries, peaches, pears, plums, prunes, grapes, and berries. The Oregon and Washington booths were somewhat of a surprise; for even among the more intelligent class of visitors, many were not aware that either state could send anything more than samples of their farm products, fish, and lumber. Certain it is that few expected to see here such clusters of Black Hamburg grapes as Oregon sent, some of the bunches weighing nearly a dozen pounds. Her orchard fruits are also of choicest quality, and especially her apples, which, for thirty years or more, have been largely raised for export.

Adjacent to the Oregon pavilion is the Florida section, where he who is so disposed may compare the fruits of the furthest south with those of the far northwest. At the entrance is an archway of russet oranges,

and near by a tall cocoa-nut tree raises its head almost to the ceiling, around its trunk an assortment of nuts, with portions of the shell removed. The walls are lined with gigantic palm fronds, beneath which are rows of cocoa-nuts and pine-apple plants, the latter in all stages of growth and bearing. By Florida were sent the first peaches to the Exposition, with a small collection of early tomatoes, cucumbers, and other fruits and vegetables out of season in the north and west, all the result of private enterprise, for there was no state appropriation for any purpose.

The artificial fruits of Germany are wonderful specimens of artistic manipulation. Crisp lettuces, large apples, somewhat speckled, juicy pears, plums, and berries, parsnips and turnips—cut through here and there to show the interior structure—and other fruits and vegetables are spread before the visitor in such perfect imitation that the closest inspection almost fails to detect them.

Near the California orange tower is a collection of Italian fruits, mainly shipped from Palermo, and opposite is a small display of apples and pears from New South Wales. When their history is known, certain red and yellow apples from the Australian colony attract much attention; for the latter have travelled hither via the Pacific ocean and San Francisco, and the former by way of the Suez canal, the Mediterranean, London, and New York. Both were shipped from the same orchard near Sydney, and those which crossed the Pacific arrived at the Fair two weeks earlier than the consignment forwarded by the Isthmus route.

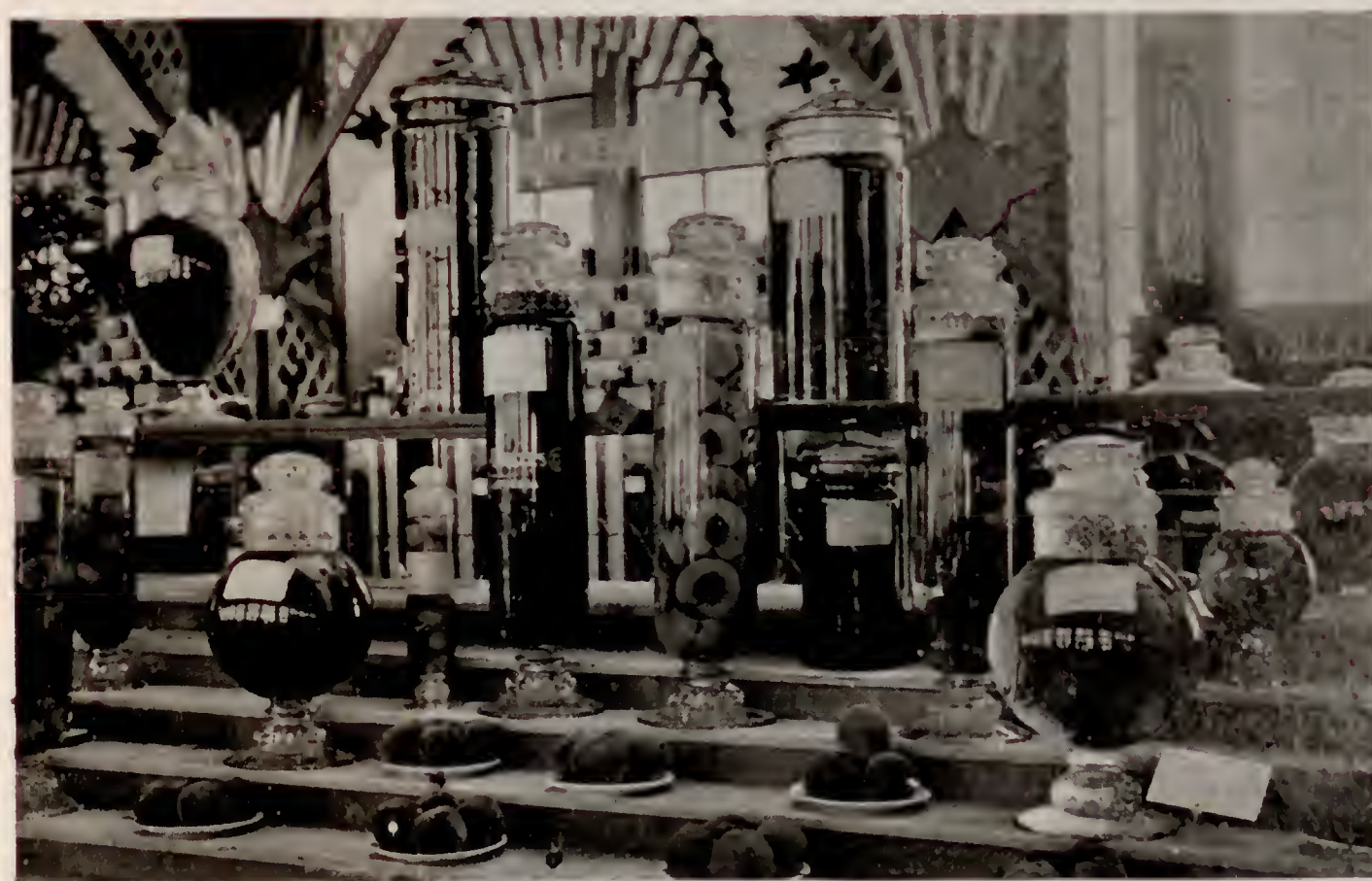
North of the main western portal is the Canadian exhibit, her specimens of berries and other fruits, fresh and preserved, arranged in four pavilions, and on triple rows of tables, the province of Ontario making the largest display. While preserved fruits form the bulk of the collection, the apples, peaches, and berries grown in the garden region enclosed by the great lakes are as fresh as though shipped from Michigan or Wisconsin. Quebec has also a moderate exhibit, and Nova Scotia and Prince Edward's Island prove their capability for producing the finest of fruits. Among the apples from British Columbia are some choice specimens from the orchards of Lord Aberdeen, now governor-general of Canada.



CALIFORNIA CITRUS TOWER



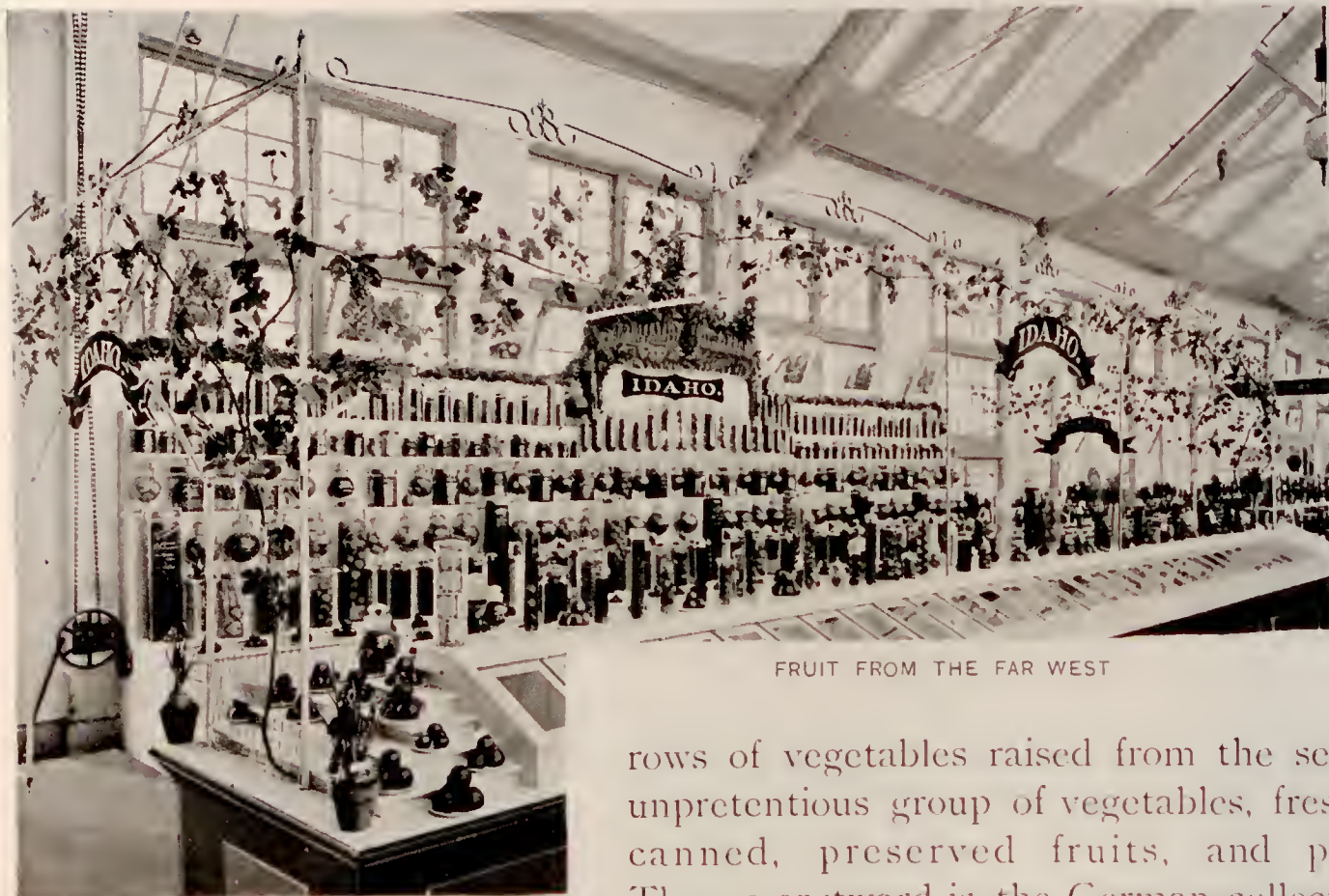
SECTION OF CALIFORNIA EXHIBIT



PRESERVED CALIFORNIA FRUIT



VIEW ACROSS SOUTH CANAL

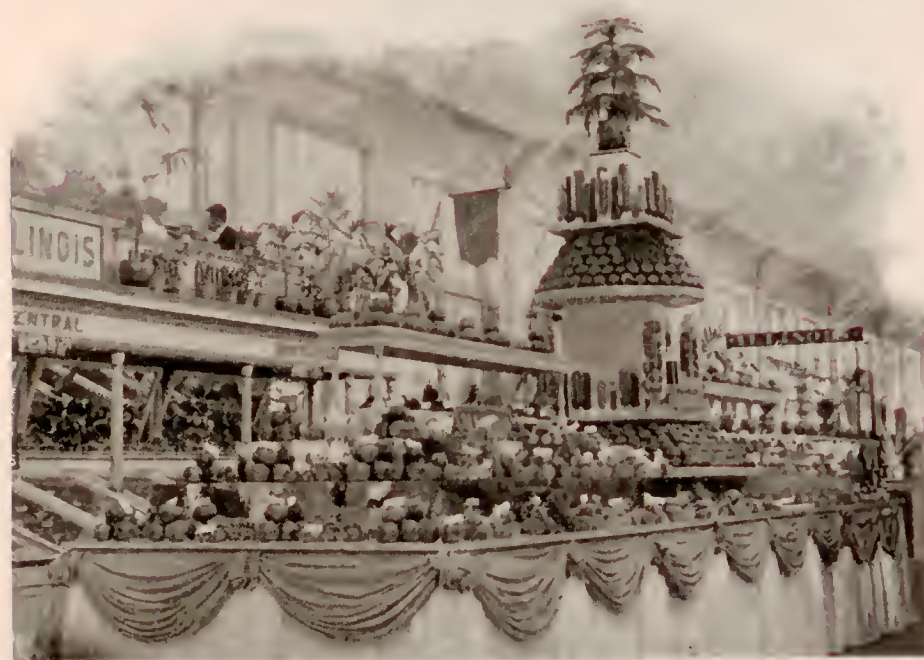


FRUIT FROM THE FAR WEST

rows of vegetables raised from the seed. Canada's space near by presents an unpretentious group of vegetables, fresh and canned, preserved fruits, and pickles. Thence eastward is the German collection of seeds, models of vegetables, garden ornaments, lawn mowers, and all kinds of garden apparatus. Three of the largest Erfurt and Quedlinburgh houses are represented in the hall, and another firm calling itself Purveyor to the Royal Prussian and Ducal Coburg-Gotha courts makes an extensive exhibit. One of the Erfurt establishments has on the screens of its pavilion a series of paintings symbolic of horticultural pursuits, with tasteful scrolls and cornucopias, gods and goddesses, plump of aspect, and flowers, fruits, and vegetables in every stage of growth.

The New York firm of Henderson and company has a large assortment of seeds, and, in the form of a mound, reproduces in papier maché all kinds of market garden products. On the summit of the mound is a model of its establishment, with workmen at the windows, elevators running to and from the several floors, and customers passing in long procession through the entrance way. Henry A. Dreer of Philadelphia, and J. C. Vaughan of Chicago and New York, have also attractive exhibits of seeds, and there are smaller collections from Ohio, New Jersey, and Utah exhibitors.

Many American, French, and German establishments show, either in the form of illustrations and pamphlets, or as actual exhibits, the latest garden appliances, both for useful and ornamental purposes. There are lawn mowers of regular size and in miniature, motionless, and engaged in cutting imaginary grass from imaginary lawns. Rustic vases, stands, seats, monuments, seals, alligators, and other hideous beasts supposed to add to the attraction of garden landscapes, are also profusely displayed. From Indiana a Bedford firm sends a number of ornamental pieces composed entirely of stone, its works being in the very midst of limestone quarries.



ILLINOIS PAVILION

Some of the figures are works of art, as those by Leonard Volk, the Chicago sculptor, and the typical gypsy, both of which are on the roof of the pavilion. Adjoining this another Indiana firm has samples of wire net-work for fences and gates. Its pavilion is of wire, the square open-work pillars trellised with vines, and within the enclosure are piles of manufactured articles.

The French exhibit in this connection, occupying a narrow strip along the northern wall, consists largely of literature devoted to the subject, with the advertisements of houses which furnish fancy baskets, seeds, twine, and all kinds of apparatus for heating conservatories, and hot-houses. A Troyes firm has a collection of knives, shears, and pruning hooks, some of them in fantastic shapes, and suggestive rather of surgical instruments than the purposes for which they were fashioned.

A liberal space in this vicinity is occupied by California products, displayed in the form of pavilions fashioned entirely of canned fruits, towers of almonds and walnuts, and tier upon tier of boxes filled with

Seeds, vegetables, horticultural implements, dried and canned fruits, nuts, and other articles from the United States and foreign lands are mainly grouped in the northern section of Horticultural hall. In a corner adjoining the display of fresh fruits the New Jersey firm, mentioned as contributing one of the most extensive and attractive exhibits in the floricultural department, erected a miniature fortress of seeds, contained in glass cases, and in thousands of paper envelopes. The summit of the glacis is covered with plume-like grasses, and beyond are



FRUITS IN SEASON



A TYPICAL SEED EXHIBIT

one which contains the products of Ohio cider presses. Its contents consist mainly of the figs of Attica, the Corinthian grape or currant, and other dried fruits from mainland and Peleponnese.

Among the gallery exhibits may first of all be mentioned a tower constructed of cases of English walnuts, forming a portion of the California collections; but here also are booths filled with the canned and dried fruits of many climes. A considerable space is occupied by the San Francisco firm of Lusk and company, in whose pavilion, tastefully decorated with silken banners, are displayed all the canned fruits of the golden state. In a corner of the gallery is shown a very simple device, which is interesting many fruit growers, and has been adopted by not a few. It consists



NEW YORK DISPLAY



THE OREGON SECTION

prunes and raisins, the last representing an industry whose growth may be inferred from the increase of pack, from 6,000 boxes in 1873 to more than 1,000,000 boxes in 1893. Of excellent quality are the prunes, and other dried fruits of Idaho, and the preserved fruits, jellies, and pickles of Kansas, and Colorado. Even the New Mexican Pueblos, the oldest of our native races, were imbued with the spirit of the day, erecting a little booth across which are printed words of greeting, and placing therein bottles and jars of preserved fruits.

New Mexico has also sent us as a work of art, a reproduction of the Horticultural building itself, in the shape of a model in silver filigree, more than 100 pounds of metal being used in its construction. In this connection may be mentioned another exhibition of fine metal and filigree work, a case filled with wreaths and flowers, closely resembling imitations in wax, displaying the skill of a German artisan. The Greek pavilion lies opposite the

of a long rod, with shears, and a canvas tube attached, so that by merely pulling a cord the stem of an apple or orange is cut, and the fruit falls into the receptacle placed beneath.

Pecans, neatly packed in cases, with photographs of Pecan bayou, as well as of the Swinden pecan orchards at Brownwood, call attention to a prominent Texan industry. Among other illustrations, scattered throughout the gallery is one of a special train of canned fruit shipped from San José, California, and elsewhere are views of the public gardens of Bremen, and the villas of Nice. Except for its well appointed restaurants, these almost complete the contents of the gallery, or such, at least, as here need special mention.

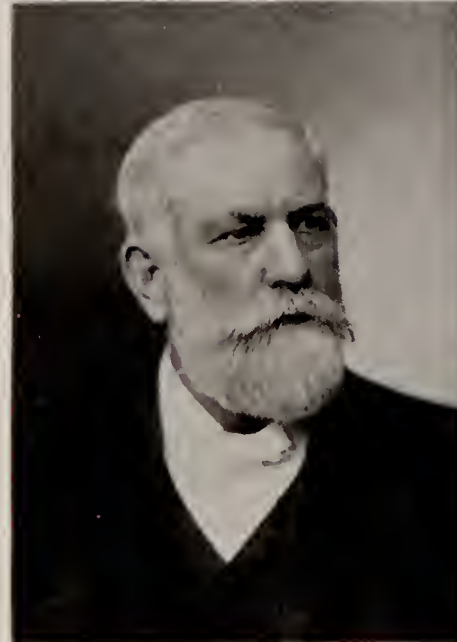
Thus, as briefly as the nature of my subject would permit, I have described the more salient and many of the minor features in the department of Horticulture, an attractive display

to all classes of visitors, and to many the most attractive in all the wide grounds of Jackson park. For the skilful grouping and management of all these varied and varying collections, credit is due, among others, to the chief of the department, John M. Samuels, and to John Thorpe, Charles Wright, and H. M. La Rue, superintendents, in the order named, of the bureaus of floriculture, pomology, and viticulture.

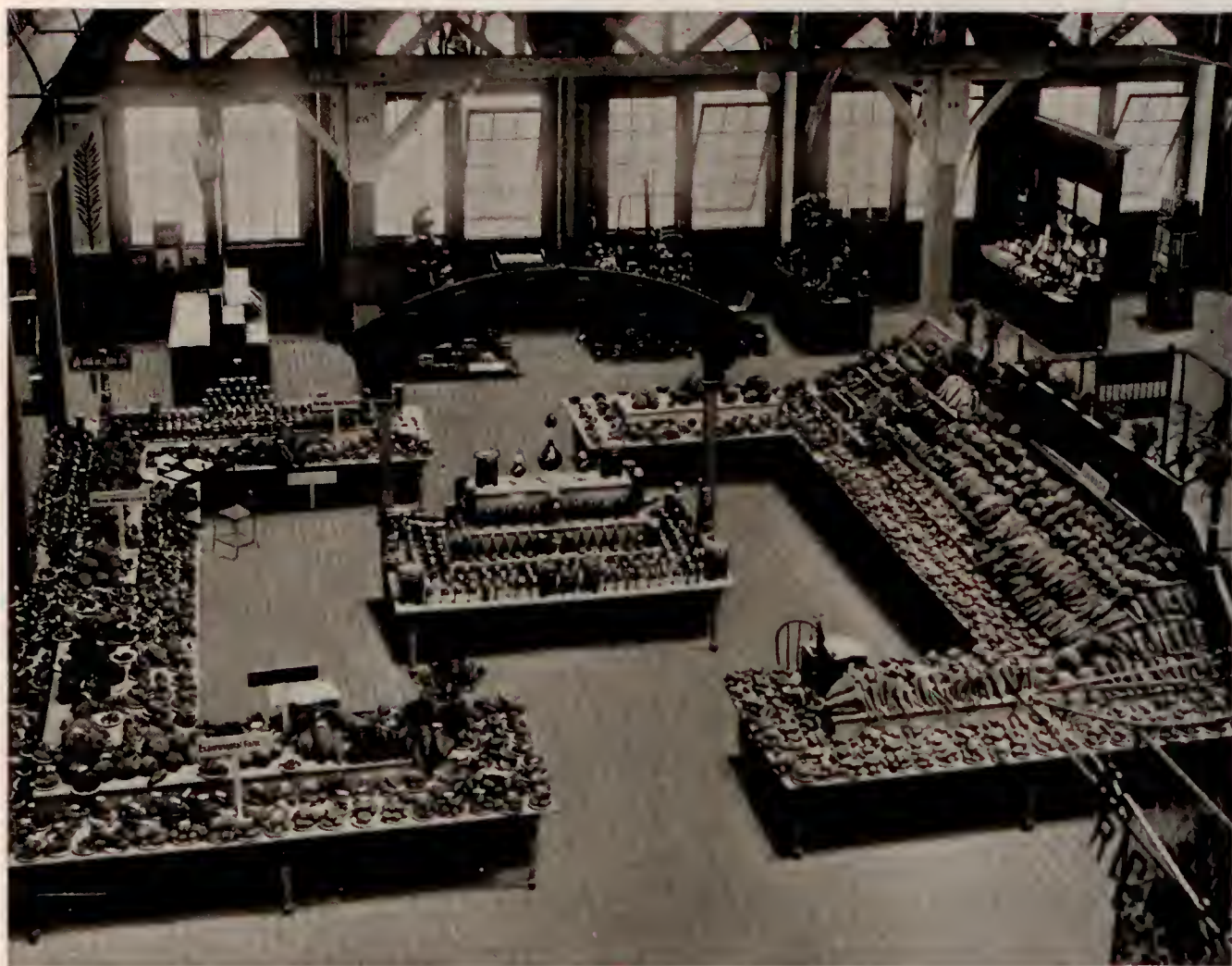
In conclusion a brief description may be added as to the out-door exhibits in

connection with this department, its conservatories, hot-houses, and grounds, with some further mention of the thousands of

horticultural and other specimens, contributed in lavish profusion from every quarter of the world. During the autumn of 1892, palms, ferns, nursery trees, and decorative and aquatic plants arrived by the car-load from the United States, from Spanish-American countries, from Europe, Australia, and Japan, until winter put a stop to further shipments. Almost before the snows had melted, the greenhouses near the Horticultural building presented signs of life, and by the middle of April at least 200,000 plants had been received at the conservatories.



H. M. LA RUE



CANADIAN VEGETABLES

In early winter thousands of Chinese primroses, hanging in dainty groups of variegated pink, white, blue, and red, represented the floral contributions of England, Germany, America, France, and Italy. Then came the Persian violets, richer even than the Chinese blossoms, issuing in regal splendor from the enfolding bulb. During the lenten season, the cineraria came forth in innumerable clusters, ranging in color from the purest white to the deepest purple. Crimson, yellow, bronze, and lavender calceolarias also revealed their beauties under the feeble rays of the sun, side by side with the English primrose, and the German hyacinth. Japanese ferns, trained in grotesque imitations of beast and fish, European pansies, and geraniums of many varieties helped to complete the opening chapter in the horticultural annals of the Exposition.

During the later spring, large beds of pansies skirted the Horticultural hall, and blossoms by hundreds of thousands were massed between it and the banks of the lagoon. Here were contributions not only from

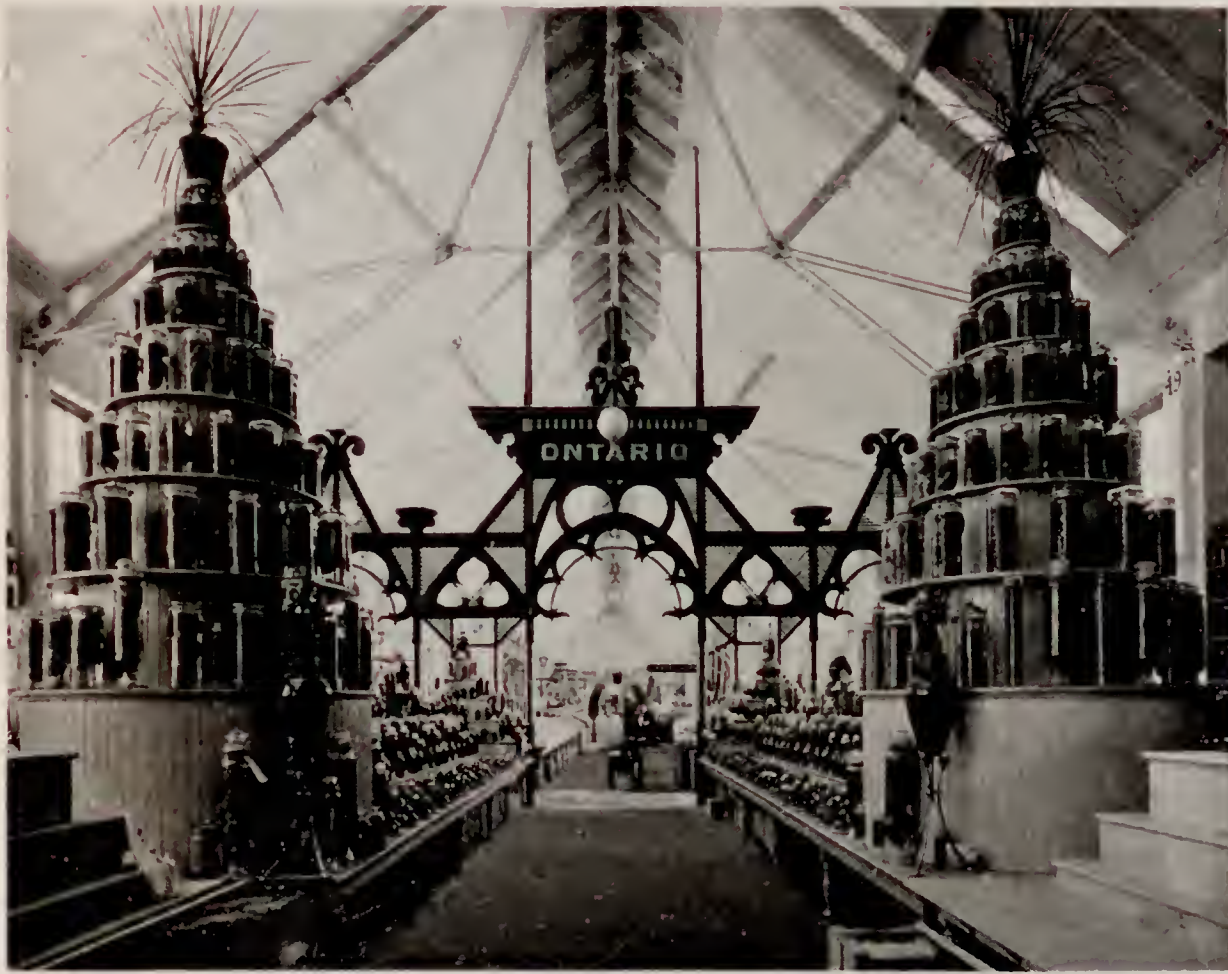
New York, Pennsylvania, New Jersey, and other states, but from Germany, Great Britain, France, Italy, and Belgium. Begonias, cannas, zinnias, and phlox flashed their bright hues around



CHARLES WRIGHT

the building, these and other floral displays giving color to the home of the Fair.

In truth there was barely a week, between the months of May and October, that failed to reveal a fresh series of flowers and blossoms, rhododendrons, hyacinths, primroses, tulips, and pansies in May; roses and lilies in June; sweet peas, peonies, tea roses, clematis, and begonias in July; hollyhocks, carnations, dahlias, asters,



CANADIAN FRUITS

verbenas, hydrangeas in August and September; and chrysanthemums, orchids, and various flowering annuals later in the season. The grounds adjacent to the hall, the banks of the lagoon, and the Wooded island opposite, were mainly selected for the out-door display of flowers, which was not only the herald of the Fair but continued throughout its term. The competitive exhibit of cannas, in which New York and Pennsylvania were rivals, was the finest ever witnessed in the United States, including more than 5,000 plants, though Pennsylvania restricted her collection entirely to French varieties.

The neighboring grounds, surrounding the Woman's building, were lavishly but tastefully decorated by France, and here was well represented the floricultural art of this nation of artists, fostered, as it is, by the Jardin des Plantes and the gardens of the Tuilleries, the Luxembourg, and the Museum.

But it was upon the Wooded island that the richest of the floral exhibits were concentrated. Here is a resting place, with winding walks, shady nooks, and picturesque summer houses covered with vines, with shrubbery and flower-beds at every turn, and with willows drooping gracefully toward the waters, above which sea-gulls, and other aquatic birds are flitting to and fro. Three bridges of the Venetian order connect with the



JAPANESE EXHIBIT



JOHN THORPE AND HIS FLOWERS

terraces fronting the Horticultural building, and with the southern shore of the lagoon. One of them, of Japanese design, leads from the mainland to a quaint structure at the northern extremity of the island. Here many visitors linger before this so-called temple of Hōōdo, or wander through a garden laid out with rare ingenuity. Here was the weird looking, long-petalled chrysanthemum, the national flower of Japan, and here bloomed the fragrant rose which the Japanese call *wichuriana*, before a stranger to this country. In this locality, more than in any other, the visitor was introduced to new and unusual forms of floral life.

The Wooded island was the special home of the rose; at its southern extremity was a gorgeous bed of



INTERIOR OF CONSERVATORY



FORESTRY BUILDING

these flowers more than an acre in extent, and near by blossomed fields of rhododendrons and lilies from Belgium, Holland, Great Britain, and the United States. The rhododendrons contributed by the Horticultural society of Ghent were remarkably beautiful, fully maintaining the reputation of that city as a floricultural centre. The roses came from almost every country in the world, forming the most complete collection ever gathered together, while honeysuckles and other vines were trained over the surrounding fences, appearing like solid masses of blossoms and foliage. Germany covered half an acre with her cheerful garden flowers. The holly trees and yews of England were not far away; and Pennsylvania and New York, California, France, and Austria, planted specimens from their fields and forests on this cosmopolitan island. But there was also a distinctly

American exhibit, in the form of a magnificent bed of sunflowers on the highest point of the island, their hardy faces hanging in clusters of thousands, and dispensing afar their homely fragrance.

He who is so disposed may wander over the bridge connecting, toward the south, with a smaller island, and there for a moment linger over the picturesque reproduction of an American hunter's camp, and the diminutive bark cabin of an Australian pioneer. The former is the headquarters of the Boone and Crockett club, an organization of prominent sportsmen throughout the United States, whose object is to preserve the large game of the country, especially that of the Yellowstone or National park. The structure is built of rough logs, and within, over the rude fire-



COLONNADE OF FORESTRY BUILDING



THE SOUTH FRONT

place, is the skull of a grizzly bear. On the floor are deer skins, and over the doorway are the broad, spreading antlers of an elk. Woolen blankets, skins, saddles, and lassos are strewn carelessly over rude tables, bunks, and chairs; field glasses and weapons lean against the rough walls, or are fastened to them; a pile of fuel is neatly stacked in a corner of the room; in short, there is nothing omitted from the furniture and equipments of a hunter's cabin. The camp is under charge of Elwood Hofer, who, for the occasion, was relieved from his task of capturing animals in the Yellowstone, or National park, for the Smithsonian institution.

Though officially classed with Agriculture, the Forestry exhibits will here be described in connection with Horticulture, to which department they would appear to be more akin. Though foreign lands are also represented, the specimens are gathered mainly from the United States, whose forests, as it would seem, are not destined to remain much longer on the face of earth, for apart from other uses, some 40,000,000,000 cubic feet are annually converted into lumber, representing an industry which keeps busy about 100,000 establishments and several hundred thousand men, with a value estimated at \$800,000,000 a year.

Of all the Exposition structures the Forestry building is, more than any other, symbolical of the purposes for which it was designed, forming, as it does, an integral portion, and perhaps the most interesting portion of the exhibits which it contains. A plain, unpretentious edifice, 500 by 200 feet, and with its main facade fronting on the lake, in style of architecture it is of the rustic order, its roof thatched with bark, its sides of wooden slabs from which the bark has been removed, and its entrances fashioned in various kinds of wood.



INTERIOR VIEW



MICHIGAN BURLS



SPECIMEN DISKS



LOG FIREPLACE, MICHIGAN EXHIBIT

But the most unique and attractive feature in this temple of Forestry is the colonnade which supports the roof of the spacious veranda, formed of the trunks of trees twenty-five feet in height, but otherwise of different proportions, arranged in groups of three, and with the largest of each triplet in the centre. About thirty states are here represented, and the flags and coats of arms of participating nations and commonwealths appear above the cornices of the veranda. A passing examination of these columnar trunks shows that the larger specimens are of red cedar, Douglas fir, bull and white pine, western hemlock, the

black spruce, the bald cypress, the tulip poplar, the white oak, and the green ash. The principal minor specimens are the Ohio buckeye, the Sitka spruce, the western larch, the red alder, the arbor vitae, red oaks, aspens, and yellow and white birches. Here are represented the forests of Canada, of the east, the south, the Pacific slope with its far northwest, including all the wooded regions from the Arctic ocean to the gulf of Mexico.

Among the most beautiful of the columns which flank the great trees are the silver maples which once grew on the banks of western rivers, or on the Atlantic coast from Maine to Georgia, and the red maples of the swamps, which still are found at intervals from Canada to the gulf. More delicate still are the birches, with bark of pure white or silver yellow. The strips which hang from the trunks seem as if covered with rime, for the birch is essentially a tree of the north. Carrying out the idea of displaying the primary forms of forest wealth in the structure of the building, its sides are composed of slabs, the frames of doors and windows being sections of logs with the bark removed. From the roofs of the verandas depend borders, or cornices, fashioned from limbs and saplings into simple geometric figures. Bark covers the roofs of both verandas and main structure, a rustic fence surrounding the latter. In the erection of the building wooden pins were substituted for nails and iron bolts, for the design of the architect, Charles B. Atwood, was to illustrate the substantial and economical work which can be done by American builders with wood alone. In carrying out this idea, and in making the building itself the primary exhibit of the department, about \$100,000 was expended, and more than 2,500,000 feet of timber were consumed.



WOODEN MANUFACTURES



SAMPLES FROM MISSOURI



SECTION OF CALIFORNIA TREE

VIEW OF CALIFORNIA EXHIBIT

A superficial examination of the Forestry building fails to disclose any main portal, for all the doors are square, and of similar pattern. Once within, however, the visitor soon discovers a spacious vestibule fronting the east, which may be considered as the principal entrance. Here is an illustration of the decorative qualities of yellow pine and cypress from the Southern Lumber Manufacturers' association, the sections of wood forming the square pillars and panels of the dado, the round columns above, the rich border of cypress, and the ceilings themselves, being highly polished, and dressed so as to show all the details of graining.

Passing thence, the visitor finds most of the massive exhibits fronting the vestibule, or grouped in its neighborhood. Around him are the products of the forests of Michigan, Wisconsin, Washington, West Virginia, North Carolina, and Missouri, and before him gigantic sections of pine and hemlock from Canada, and slabs of polished woods from the wilds of Australia, while in the very centre of the hall is a massive monument containing specimens from all the exhibiting states and countries. Scores of huge blocks and polished sections of wood are arranged around the mammoth redwood from California, which has carried away the honors of the entire display, an arrow and the head of a brass tack upon its face indicating the diameter of the tree at the time of the event which the Exposition celebrates. Another object which attracts almost as much attention is one of the axes which England's premier uses so vigorously upon the trees of his Hawaarden estate.

To the northeast of the vestibule are the evidences of Michigan's forest wealth. A rustic gateway gives entrance to the exhibit, the cabinet which incloses it being highly polished, and neatly panelled bird's eye maple, oak, elm, walnut, and other varieties entering into its construction. An odd conceit, and one deftly executed, is that of placing



SETTEE IN NORTH CAROLINA SECTION



IDAHO'S PINE



LUMBERING TOOLS



RED WOOD PLANK FROM CALIFORNIA

in the cornices several transverse sections of small logs, with the bark only removed, hatchets, saws, and compasses carved out of wood appearing at various points, and completing the decorative scheme. Over the main entrance is the symbol of the state, two stags engaged in combat with an eagle between them, and specimens of pine, cedar, and poplar are contributed by her experiment station. The furniture factories of Grand Rapids and other cities of southern Michigan find in the specimens of walnut, oak, maple, and pine here displayed, one of the secrets of their success. In a small photograph gallery within the pavilion are shown the enemies of Michigan woods, one view depicting the ravages of the web-worm upon the poplars of a city avenue, every leaf being stripped from the branches, while upon the opposite side of the street is a row of flourishing maples exempt from the plague. In a corner of this section is a rough fireplace made of logs, and in the centre a miniature fortress of gnarled trees. Various forms of manufacture are also represented, as sulphite fibre, basket-work, and wooden-ware.

Wisconsin has erected a neat pavilion built of her native woods, with six varieties in each of the twenty hexagonal columns which support the birch bark roof. The floor is of cherry and birch planks, and between the pillars are two-score blocks of timber which have a commercial value. In the centre of the structure are logs of pine, oak, and other varieties, with smaller sections arranged on stands. In branches and seeds are also represented the pine, spruce, birch, and hemlock forests of northern Wisconsin, as well as the cultivated elms and other ornamental trees of the southern portion of the state. Upon the walls and scattered throughout the specimens are many colored pictures and photographs depicting scenes in logging camps, saw and lumber mills, showing some of the largest loads of logs which have ever been hauled from western forests, one of them twenty-one feet high and twenty in width.

A score of people might stand on one of the mammoth disks of cedar which Washington has laid upon the floor; and this is by no means the best that the forests of the evergreen state can do, though here as in her own building is an imposing display. Missouri woods include many varieties, with rough sections of trees and others dressed and polished, among which may be noticed the delicate graining and tinting of the holly; aspen, yellow cypress, and silver maple. This exhibit is inclosed by a wall of tree trunks cut in regulation lengths, including about 150 massive specimens.

In an adjoining section, the forests of West Virginia are displayed in a collection of photographs. Forests of pine, spruce, chestnut, beech, oak, cherry, and black gum, and logging scenes in the mountains, and along the rivers, are all represented by the artist, and there is a circular tower of woods with gigantic poplars and tulips at the base. A lumber company shows hardwood capable of taking a beautiful finish; a Parkersburg mill company has an exhibit of brush handles and wainscoting, and the Standard Oil company one of the barrels used in its export business.

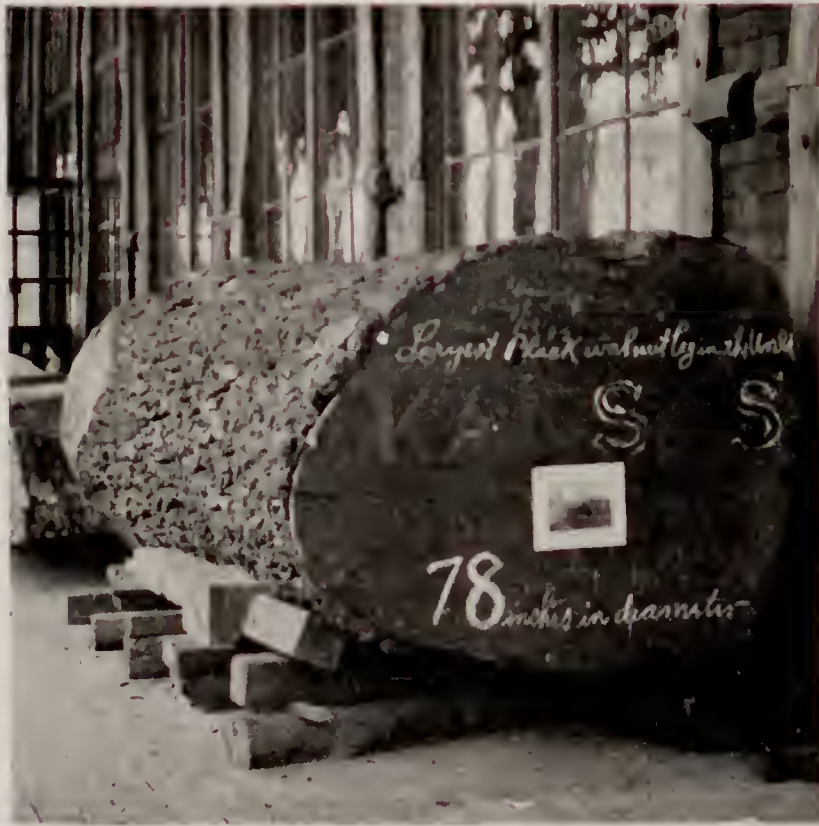
North Carolina has an extensive and varied display, rugged specimens and photographs of timber trees conveying an excellent idea of her forest growth. Here also is a large display of nuts, seeds, cones, and bark, and a small collection of balsam, turpentine,

THE BOOK OF THE FAIR



HOUSEHOLD WOODENWARE

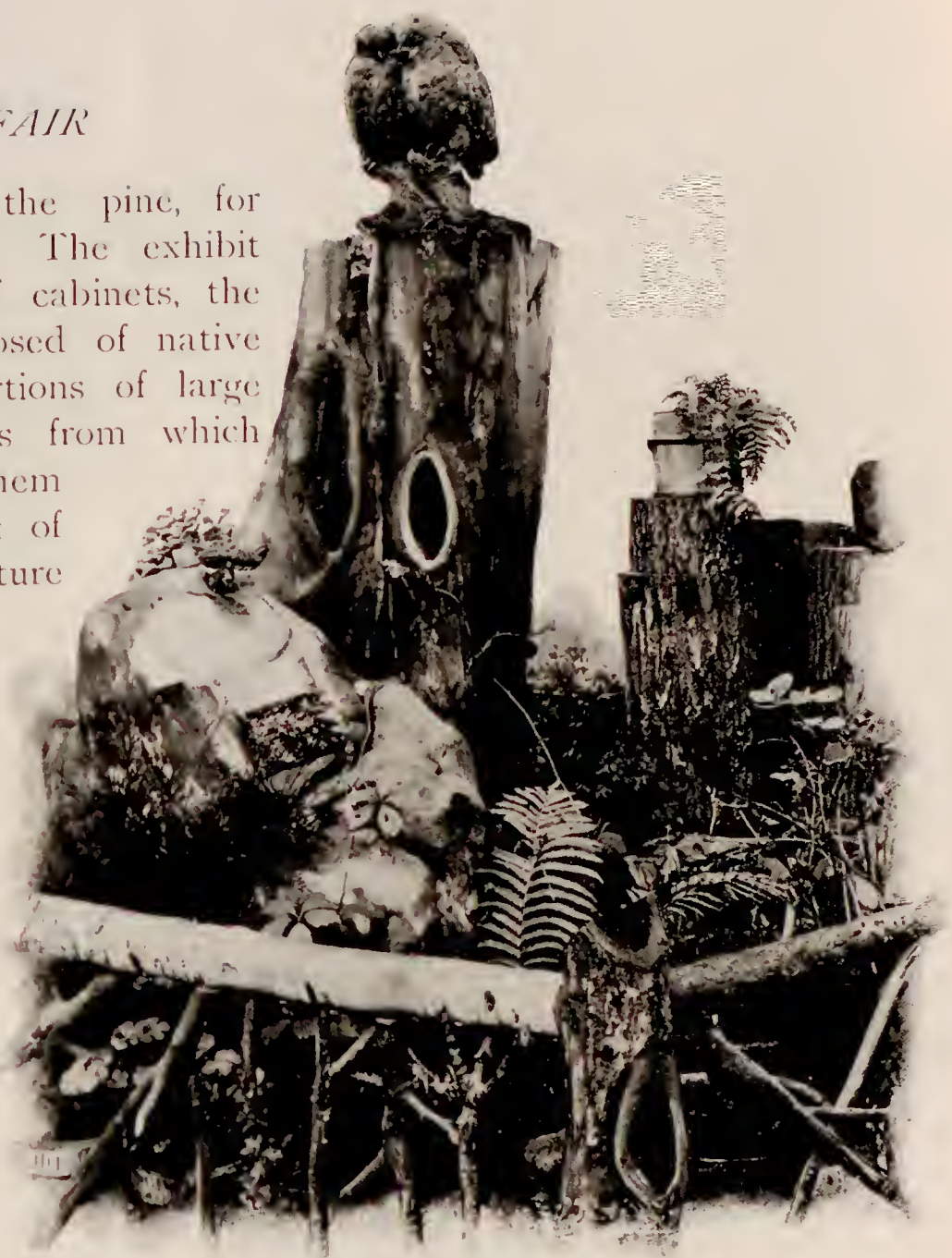
hemlock belt ranges from an altitude of 2,700 feet in British Columbia to 10,000 feet in the sierra of central California; that the Douglas fir grows from 200 to 300 feet in height, and that it is the most generally distributed timber tree of the Pacific coast; that the arbor vitae flourishes best in the swamps of the north, and the cottonwood on the banks of the Ohio river, and that the balm of Gilead species has as its territory Canada, the United States westward to Colorado, and the entire northwest as far as the Arctic ocean.



WALNUT LOG FROM KANSAS

and other products of the pine, for which the state is noted. The exhibit is arranged in a series of cabinets, the bases of which are composed of native woods, and the upper portions of large photographs of the forests from which they were cut, some of them 7,000 feet above the level of the sea. A valuable feature in this section is the views which illustrate the results of scientific forestry, as conducted on the Asheville estate of George W. Vanderbilt. In one of the corners is the graceful form of the palmetto tree, the symbol of the sister state, which is not represented in this section of the Fair.

Among the many interesting groups lying south of the main vestibule are the Jesup collection of American woods, and the exhibits of California and New York. The Jesup collection is a duplication of the cabinet in the New York museum of natural history, similar in scope to the display of native woods in the Government building. Each of the 430 specimens is labelled with an outline map, showing the area in which the tree is indigenous, together with a description of its characteristics. Here, for instance, one



CORNER OF MINNESOTA SECTION



INTERIOR OF OHIO PAVILION

In the adjacent exhibit of California

the redwood, laurel, walnut, maple, elm, locust, madrona, and the so-called big trees stand row by row like gigantic sentinels, their faces polished, and displaying all the beauties that timber can be made to assume. To many visitors these are somewhat of a revelation, for here were for the first time shown to them the excellencies of California woods for cabinet and ornamental purposes. Here also are festoons of cones, burls of curious shape, and an unadorned section of a redwood that might serve for an ordinary table.

The New York state exhibit, which occupies a large space in the eastern portion of the hall, presents a striking illustration of the forest growth of the empire state. In revolving frames are thin sections of her trees, with their seeds, bark, and leaves, and within each frame are photographs, one showing the tree from which the

different parts were taken, and another a portion of the trunk. Among the collection are such varieties as the Norway pine, the English cherry, hickory, spruce, balsam, balm of Gilead, fir, tamarack, larch, hawthorn, cedar, sycamore, black walnut, poplar, hackberry, birch, elm, ash, maple, and chestnut. Many of these are also reproduced in photographs, together with landscape scenes adjacent. Another feature in the New York exhibit is that which shows the texture of different woods, and different portions of the same wood. Sometimes the specimens do not exceed the twelve-hundredth part of an inch, and when placed against the light, not only show forms of geometric combination but reflect colors of exquisite tint. When examined under a microscope even greater wonders are revealed.

In the southern section of the hall Connecticut has a rustic booth of cherry wood, its specimens of burl oak, walnut, pine, ash, hickory, etc., in sections of which one side is polished, and with

seeds, foliage, and twigs as adjuncts of the display. No less artistic is the exhibit of Massachusetts, both of them demonstrating that while eastern woods are of smaller size, the grain is finer, and the timber more durable than in western varieties. A New Jersey firm in this vicinity shows some of the uses of eastern spruce and poplar in a group of tubs, pails, bowls, measures, and pans, pressed from the pulp of these woods, and said to wear like metal, besides being odorless and seamless.

In this vicinity Colorado places a giant poplar cut from the first tree planted under her timber culture act of 1877. Great firs, spruces, and other varieties form the corner pillars and base of the booth, while above are the trunks of such trees as the black-thorn, dog-wood, hackberry, wild cherry, black cottonwood, dwarf birch and maple, hazelnut and mountain mahogany, some of them taken from the cañons of the foot-hills, and others from the mountains thousands of feet above. In a series of frames are sprigs from the yellow and fox tail pine, the black birch, red fir, cedar, sage brush, box elder, and quaking aspen; also a row of jars filled with buffalo berries, wild plums, choke cherries, and seeds of

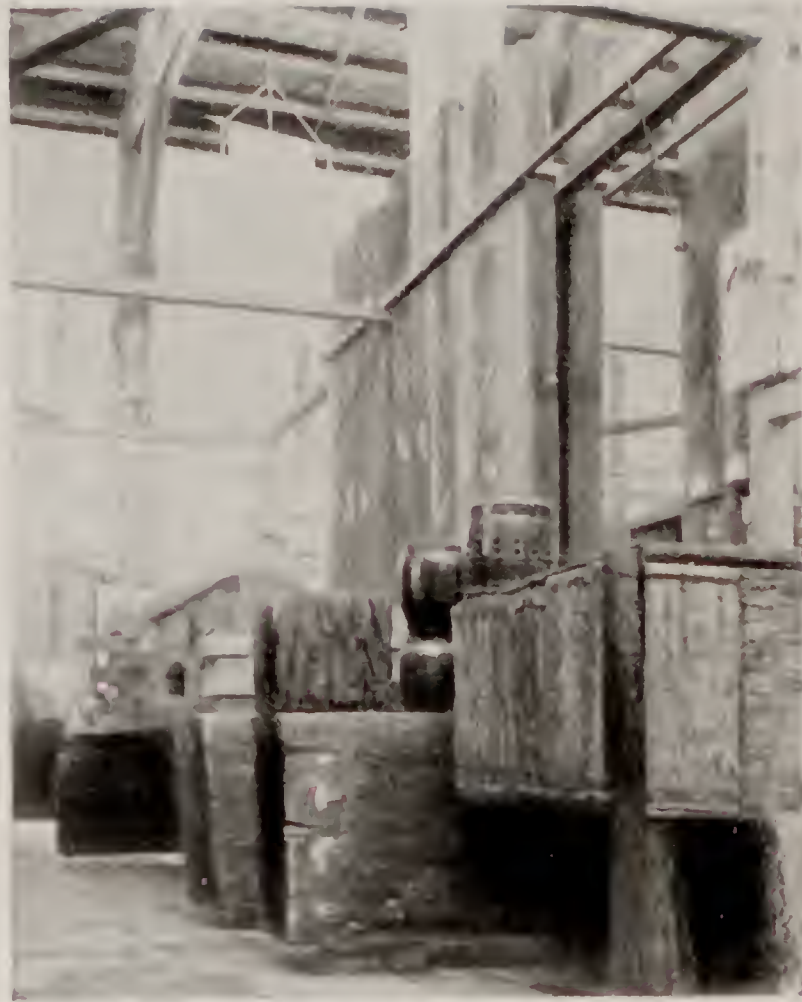


CANADIAN EXHIBIT



ENTRANCE TO QUEBEC SECTION





SLABS FROM AUSTRALIAN FORESTS

the Douglas fir and balsam. The bulk of the silver state's exhibit comes from her agricultural college.

Close to the Connecticut pavilion are the exhibits of Florida, Arizona, and Idaho, the woods of the peninsula state being mostly furnished by railroad companies. Those of Arizona and Idaho consist mainly of pine, the former state asserting that while

she has been called a treeless desert, there are within her domain 2,000,000 acres of pine untouched by the woodman's axe.

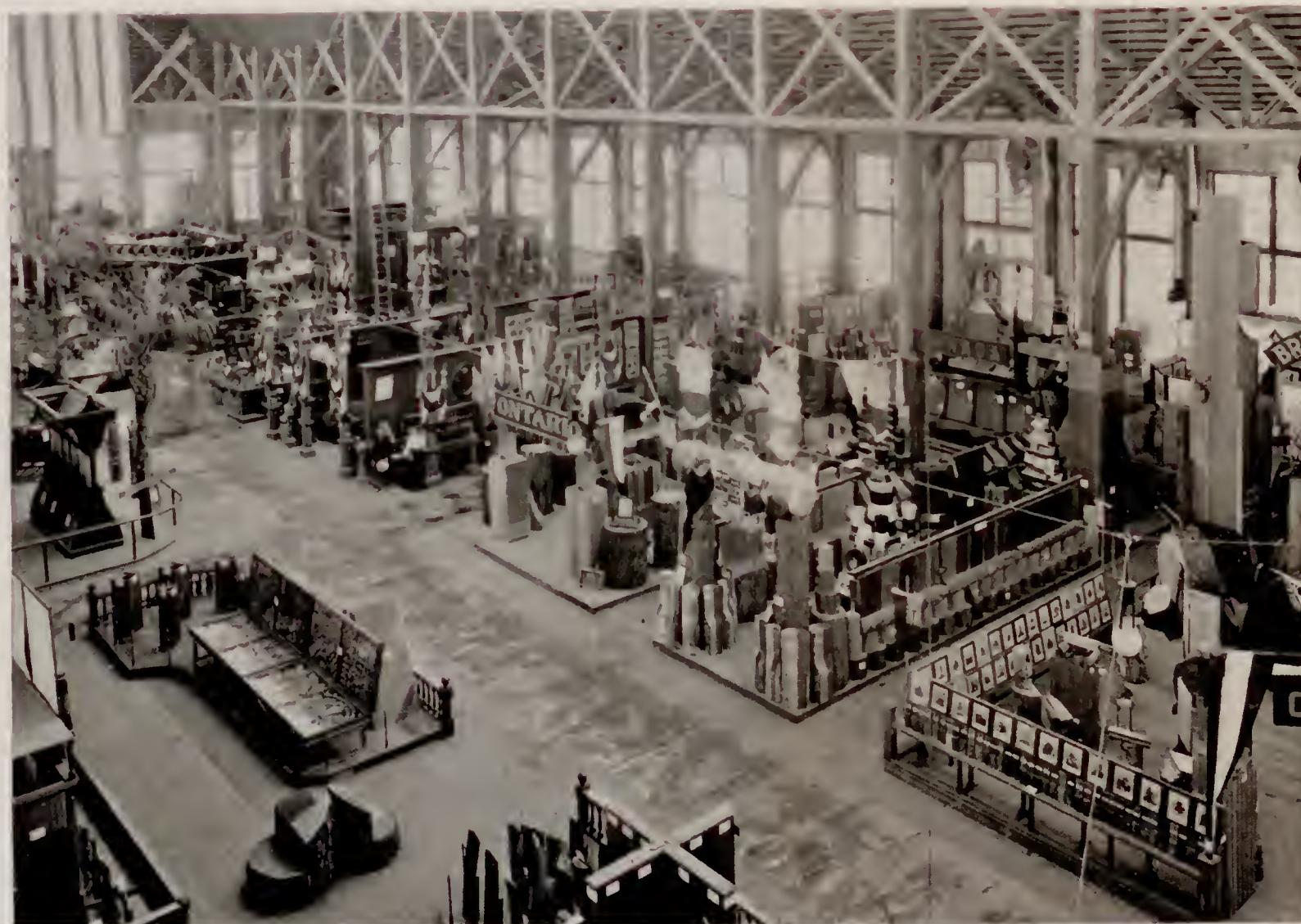
In the southern portion of the Horticultural hall are grouped the individual exhibits, one corner being filled by a mammoth redwood wine tank, constructed within the building by a San Francisco firm. Across the way is a pyramid of tubs, pails, and other wooden ware from a Chicago house, and near by is a large assortment of wooden knives, forks, rolling pins, scoops, bowls, and medallions. A pulp and paper company shows in a series of jars, with explanatory labels, the processes through which spruce chips pass, from the crude material to the bleached pulp, and to colored rolls of paper. In various devices, some of them approaching the artistic, such as pictures made of the shavings and other fine sections, one of the exhibitors reproducing St Peter's and picturesque scenes on the Rhine, with remarkable fidelity. Among other exhibits are trees in their natural state, and trees of which nothing is left but their outer coverings, or the portions from which the cork is cut. There is cork piled up in slabs like cord wood, and



ENTRANCE TO ONTARIO PAVILION

Not far away are booths in which is shown cork in various devices, some of them approaching the artistic, such as pictures made of the shavings and other fine sections, one of the exhibitors reproducing St Peter's and picturesque scenes on the Rhine, with remarkable fidelity. Among other exhibits are trees in their natural state, and trees of which nothing is left but their outer coverings, or the portions from which the cork is cut. There is cork piled up in slabs like cord wood, and cork tables, towers, and pavilions.

Near these are specimens of wood-turning, in the form of snakes coiled for attack, billiard balls, charms, watch-chains, stair and chair ornaments, flowers, and nearly everything that has been accomplished in the way of decorative wood-turning. A choice and varied display of foreign woods is that of the E. D. Albro company of Cincinnati. Upon a large platform, above which are the flags of many lands, is grouped an array of polished slabs, such as are used in cabinet work. Surrounding the platform are rows of upright posts, cut from valuable timber, as the ebony of Ceylon, the red Brazilian tulip, the



ONTARIO EXHIBIT

rich brown lignum vitæ, the fine grained and yellowish shittim from Palestine, and the Amazonian cocobola, rosy red, and with patches of gold near the bark. Piled high upon the platform are slabs of mottled brown Persian walnut, yellow Brazilian satin-wood, the Turkish ash, and the white mahogany of Mexico with its delicate cream color. Near by is a collection of implements, such as are used in lumber regions, and adjacent to these a group of household appliances in structural form, manufactured from the aromatic cedar of Virginian forests. A Detroit firm displays a large plank from a California redwood, with the oil finish of which it makes a specialty. A Chicago establishment has a pavilion composed of many varieties of wood, in the finishing of which its varnishes are used, and a manufacturer of wooden faucets, saturated with india rubber, has a structure built of bark, with arched doorway whose keystone is of cork.

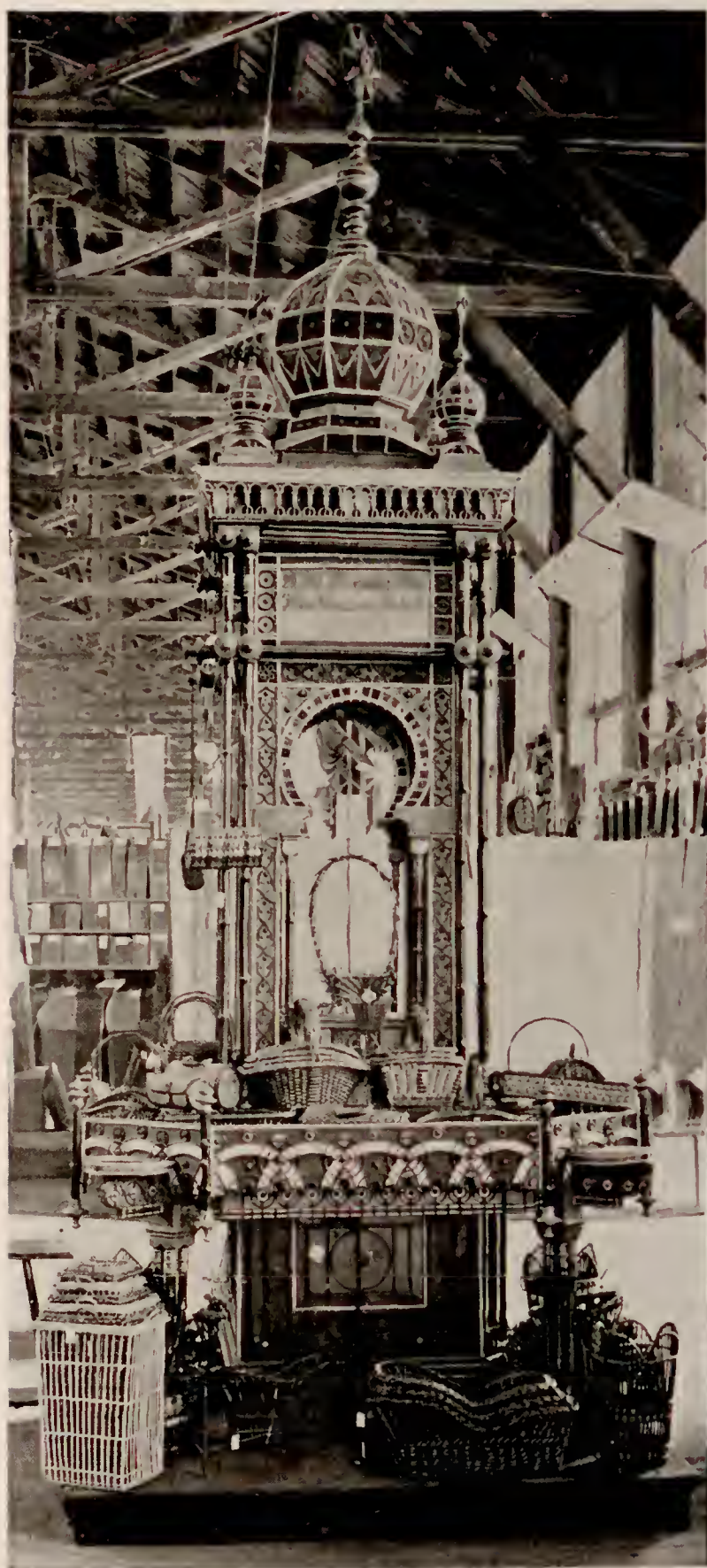
The northeastern quarter of the Forestry building contains, in addition to the exhibits already described, those of Pennsylvania, Ohio, Wisconsin, Minnesota, Nebraska, North Dakota, Oregon, Virginia, Louisiana, and Kentucky. The display of Louisiana, whose forests are yet almost untouched, forcibly illustrates one of the great resources of the southern states. The pavilion is of cypress, pine, oak, ash, and other native woods, surmounted with a cupola, and with pillars and ceiling handsomely carved and inlaid. In the

decorative scheme are reproduced the leaves, flowers, and branches of Louisiana trees,

and within are represented in various forms her sturdy oaks, her lofty pines, her graceful willows, her rapid-growing chinars, and stately beeches and ash, with the creamy-blossomed magnolia, the fan-like palmetto, the wide-spreading elm, the moss-hung cypress, and the odorous cedar. Some of the specimens are in the form of large square blocks, one side retaining the bark, and the other showing the wood stripped of its outer covering, with samples of hewn timber, such as reveal the beauties of the polished surface. Upon the blocks are partially manufactured articles, illustrating the uses, commercial and ornamental, to which the wood may be put. An interesting series of maps and charts explains how the timber is cut and floated along an intricate system of bayous to the saw-mills on the Mississippi.



DOUGLAS PINE FROM BRITISH COLUMBIA



WILLOW WARE IN GERMAN SECTION



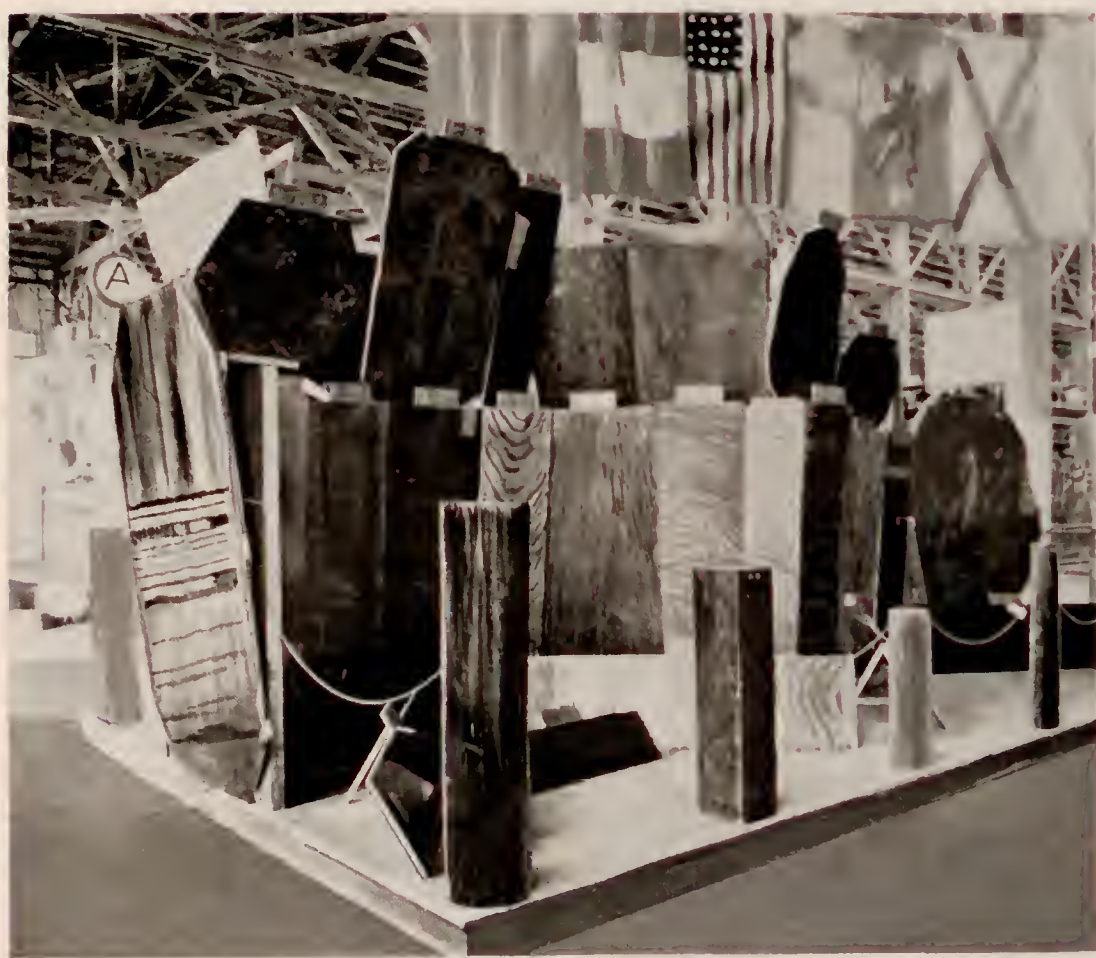
FRENCH WILLOW BASKETS



THE ADMINISTRATION PLAZA

Virginia has but a scant display of forest woods, while Kentucky is somewhat of a surprise. The entrance to the latter section is through a hollow segment of a sycamore tree, sixteen feet in diameter, which grew in the neighborhood of Fairview, the birthplace of Jefferson Davis. To the right is a huge yellow poplar; to the left a great white oak, and in a series of pyramids are native woods in 150 varieties, while in a relief map are shown the timber areas, the logging streams, and other matters connected with the lumber interests.

Minnesota has also an interesting exhibit in her rustic pavilion surrounded by a fence upon which are perched in life-like form, birds, gophers, and other specimens of her fauna. The display is of an instructive rather than a massive character, such as might have been expected from her boundless forests, and the numerous industries connected therewith. A few blocks of pine there are,



POLISHED MEXICAN WOODS

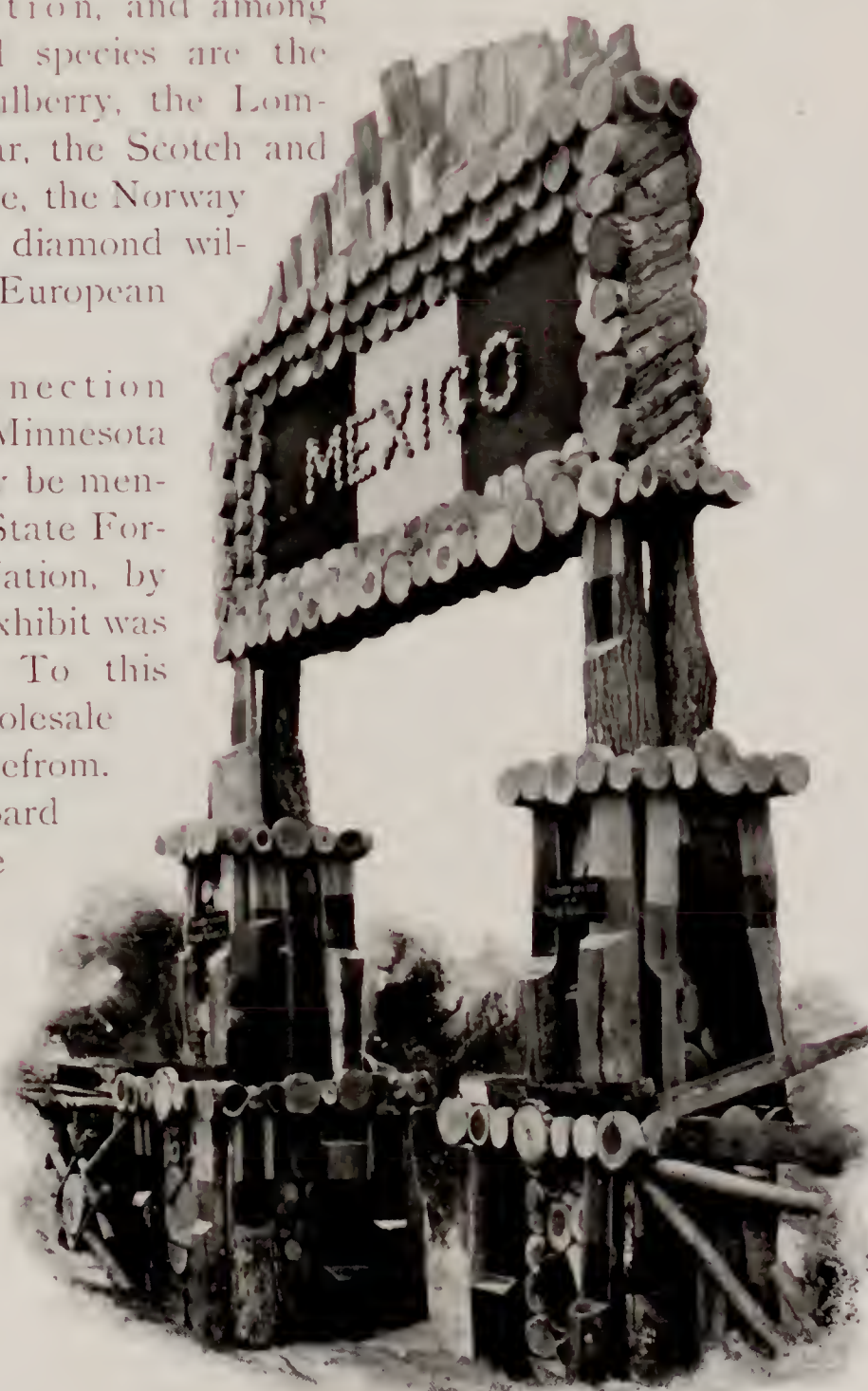
bearing carved stars upon their faces; but elsewhere are only simple specimens of cultivated trees. A section of European larch is shown, which is said to have grown further north than any tree of its kind. A block of Minneapolis cottonwood is historic, for it was hewn from the first tree planted in that city, nearly forty years ago. All the native varieties are on exposition, and among transplanted species are the Russian mulberry, the Lombardy poplar, the Scotch and Austrian pine, the Norway spruce, the diamond willow, and the European larch.

In connection with the Minnesota display may be mentioned her State Forestry association, by which the exhibit was organized. To this

institution credit is due for its efforts in calling attention to the wholesale destruction of forests, and the climatic and other evils resulting therefrom. It has also repeatedly urged upon congress the appointment of a board of forestry commissioners for protective purposes, and to promote the science of arboriculture. Among the purposes of the Forestry department of the Exposition is to collect information from every quarter as to the amount of valuable standing timber, the effect of forest destruction on climate and soil, and the results which have followed the adoption of various timber culture acts. It is intended to demonstrate the wealth of our forests, ascertain the ratio of consumption and destruction, and the efforts made to counteract this destruction, through the preservation of timber tracts, and the planting of new areas. This is accomplished not only in the exhibits themselves, but in maps, photographs, reports, and literature devoted to the science of forestry. Nebraska and North



INTERIOR MEXICAN PAVILION



OUR SISTER REPUBLIC

Dakota especially demonstrate the benefits of tree-culture, and one of the most prominent objects in the former section is a life-sized portrait of J. Sterling Morton, to whom Arbor day owes its origin, for many years a resident of that state, and now secretary of the national department of agriculture. The Nebraska pavilion is of the rustic order, with a mammoth cottonwood disk at one of the entrances, and on arches and pillars,



MEXICAN MAHOGANY BLOCK

composed of cottonwood, linden, honey locust, ash, and elm, are sprigs of green grown from the trunks since they were placed in Forestry hall. One of the curiosities here displayed is a horseshoe embedded in the heart of a big cottonwood hung on one of its limbs a dozen years ago, and imprisoned by its growth.

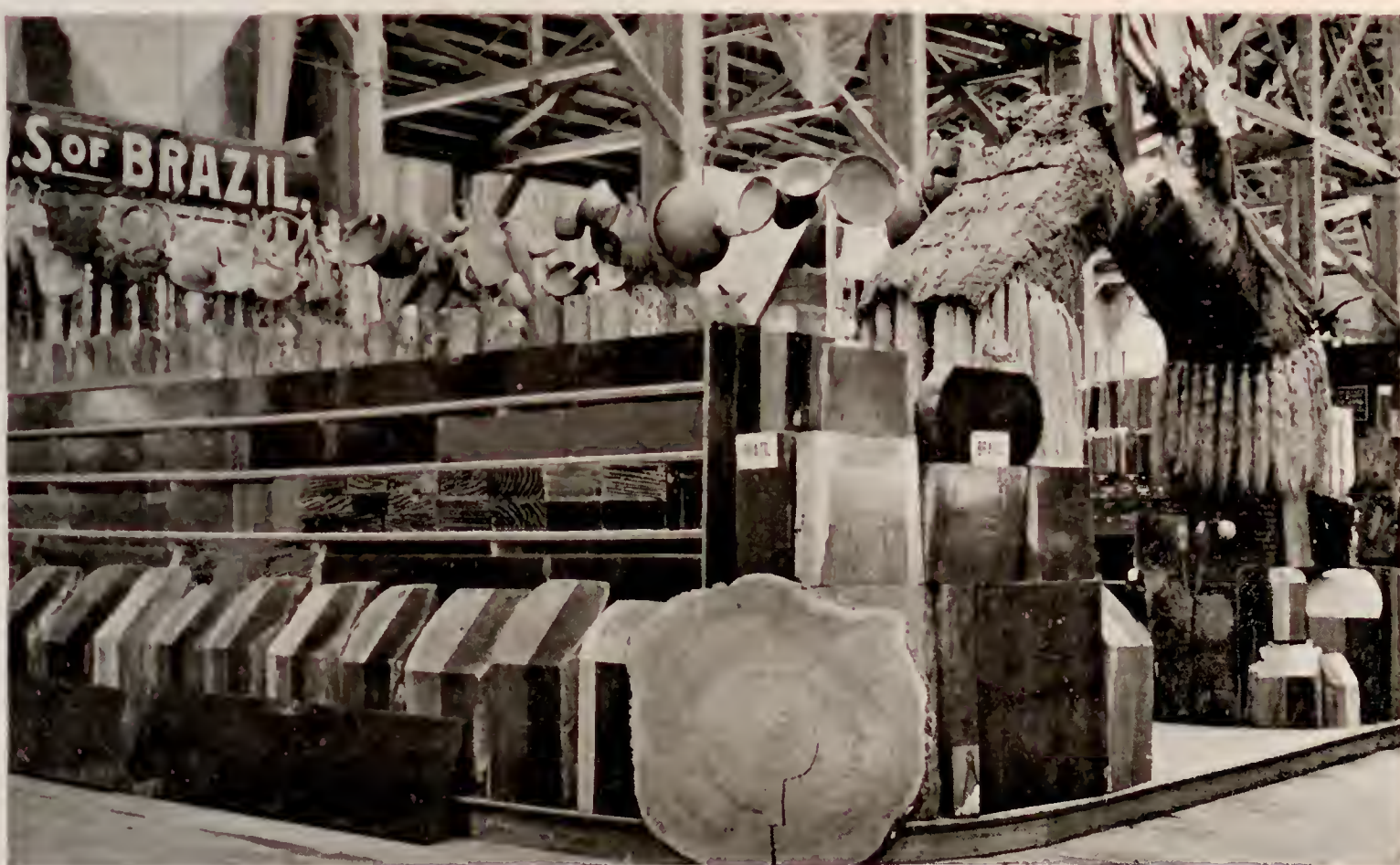
In the huge logs cut from planted trees exhibited by North Dakota, is shown what may be done in the way of arboriculture on prairie soil. A thick section of bark forms the back of a chair, the body of which is hewn from the trunk, and the various specimens are labelled with the ages of the trees, and the conditions under which they were planted. Near at hand is the square pavilion in which Ohio presents a complete display of

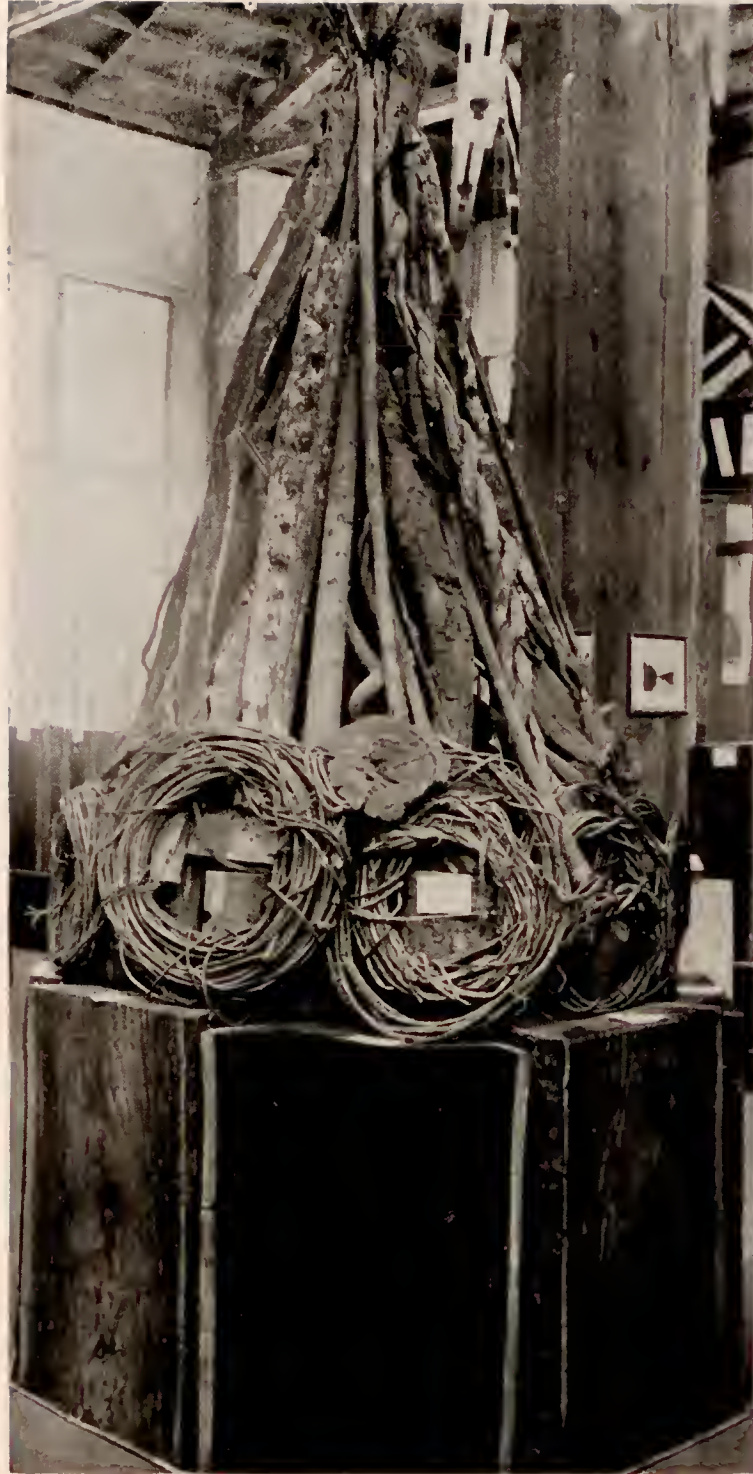
medicinal plants, with more than eighty specimens of native forest trees in the form of twigs, leaves, flowers, fruit, and section of trunk and bark, in the rough and polished; the latter profusely illustrating the graining of woods suitable for turning, cabinet work, and interior finish. The walls of this structure are covered on both sides with framed specimens of herbs, bark, twigs, flowers, fruit, and foliage, the pillars forming samples of rough wood, and polished slabs the panels below the cornice.

At the northern end of the Forestry building Pennsylvania shows several hundred varieties of her native woods, together with a model saw-mill, with logs being drawn up its front incline, and in the yards behind piles of finished lumber, while on the roof are rows of water barrels as a safeguard against fire. Into the Oregon booth adjacent, the visitor enters between huge sections of yellow fir and spruce, the latter cut from a tree 305 feet high, and 16 at the base. Within, the commission has a beautifully finished office, the side walls formed of polished planks of fir and spruce, contributed by the lumbering and mill companies of Astoria and Portland.

In the northwestern portion of the Forestry building is a collection of cedar, pine, oak, cherry, cottonwood, and other varieties from the territory of Utah, one that seems out of place, pushed aside, as it is, into a corner among the foreign exhibits; for here is a valuable exposition of what can be done in the way of tree-planting under most adverse conditions, and nowhere has arboriculture been conducted with more of system and success.

Almost in the centre of the western division of the hall are the exhibits of New South Wales and Canada. In the Australian collection are more than ninety varieties of hardwood, enclosed by upright planks, polished to a distance of six feet from the floor, and forming an excellent sample of antipodean workmanship. From the top of the booths float the flags of the Australasian colonies, and above all is an ensign bearing the inscription "Advance Australia," which is seen in many other departments of the Exposition. The outer wall is largely composed of the most valuable of Australian timbers; ironbarks, red, grey, white, and black; gum trees, spotted, grey, blue, red, and white;





JAPANESE SLABS AND FIBROUS WOODS

woods, and a model of a church, also designed to display the variety of her forest products. British Columbia, whose pavilion is adorned with the heads of deer, has several of the largest sections of Douglas fir contained in the Forestry building.

In the French section, adjacent to the Canadian groups, are specimens of cabinet woods, cut veneers, osier work, and mosaics in wood, fashioned and grouped with the skill and taste of the Frenchman. In paintings, photographs, and maps are scenes among the picturesque regions of the French Alps, thickly clad with the pine forests which the government protects with zealous care. There is also an excellent display of conifers, and of such forest products as pitch, tar, and resin.

The German collection is in the northwestern portion of the hall, grouped, for whatever reason, among

those of South American nations. This exhibit may be considered as the chief exponent of scientific forestry, as represented at the Fair. In maps are shown the forest distribution in many portions of the empire, the changes in their condition under forest management, during a large number of years, and the temperature of the soil within and without the forests. Instruments are displayed recording the temperature of the soil, and measuring the growth of trees, and there are models of logging railroads and tree-planting tools. In a chart prepared by the royal forest inspector of Bavaria is explained the nature of the soils in his territory, and the experimental station at Munich describes, in an object lesson, the ravages of the

blackbutt, woollybutt, and tallow wood. Some of them grow to a remarkable height, the blue gum-tree reaching an altitude of more than 300 feet. Piles of monster logs are trimmed to show the fibre of the tree, one of red cedar from New South Wales being nine feet long and six in diameter. There are also slabs of lignum vitæ, river oak, rosewood, quince, black oak, sassafras, myrtle, and elm, with sprigs, bark and seeds of the same varieties, and in large photographs, hung upon the walls, are depicted the vast forests from which they were taken. Among the most valuable forest trees of New South Wales are the red gum and iron bark, one of the uses of which is illustrated in a large pile of railroad sleepers in the centre of the enclosure. A few feet away is a photographic reproduction of Sydney streets, representing the paving of one of her thoroughfares with pine blocks. Pictures of lumber mills and factories indicate the development of industries whereby the raw material is transformed into primary forms of manufacture.

Massive logs, blocks, and slabs of timber, heaped within and around the areas occupied by Quebec, Ontario, British Columbia and the northwest territory display their wealth of pine, spruce, tamarack, cedar, balsam, birch, ash, maple, cherry, butternut, and other valuable woods. Quebec has a strong exhibit with many materials in the rough, and an exposition of the progressive stages in the manufacture of wood pulp. The entrance to her section is broad and square, composed of untrimmed logs, and a wigwam of bark in the rear is suggestive of the fragrance of her forests. Ontario and British Columbia have each a separate pavilion, the former showing a large picture frame inlaid with native



ENTRANCE TO JAPAN SECTION



INTERIOR JAPAN SECTION



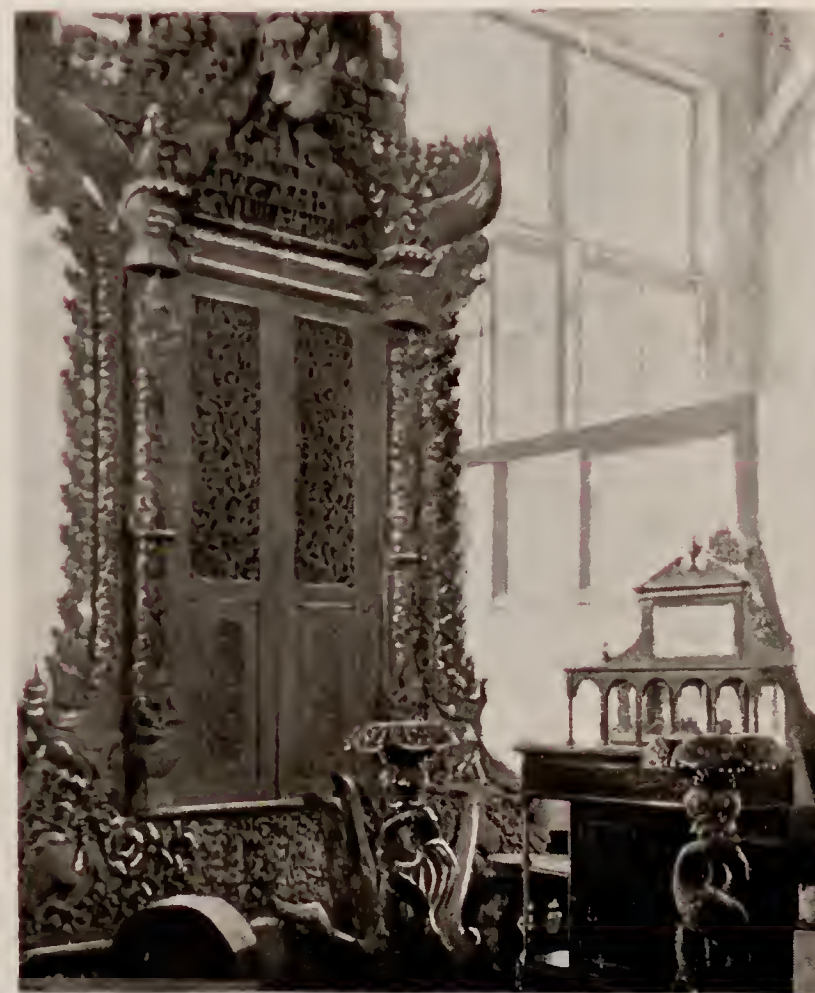
SIAMESE EXHIBIT

pine moth, while the forestry schools connected with the universities contribute to the interest of the display. There are also specimens of tannin and tannin extracts, basket ware, cork, and that which is made of cork.

Germany may be considered as the mother of scientific forestry among European countries. In the seventeenth century arboriculture was studied by her learned men, and a hundred years later was being systematically taught in her colleges. Meanwhile the movement had spread to Russia and Austria, and later, schools of forestry were also established in France and Spain, where before the application of remedial measures, many of the mountainous and wooded districts, formerly supporting large populations, had become almost deserted. To-day, apart from the United States, the governments of all the leading countries in the world so manage their forest tracts as not only to insure their preservation, but to derive large revenues therefrom. France has 7,500,000 acres of national forest lands, and individuals nearly twice that area. One half of the 20,000,000 acres of Prussian timber lands produces a net annual income of \$6,500,000, while Saxony's 400,000 acres yield a return of more than \$1,200,000. Here in truth are lessons which our own republic might profitably lay to heart.

In the Russian section, photographs and maps convey information as to the areas covered by forest lands, and also reproduce the imperial hunting parks, and the pavilions erected thereon. Leaves and seeds are displayed in mounted specimens, and the department of the Volga furnishes models of the ovens used for boiling pitch, and the rafts that convey it to centres of shipment or consumption. The St Petersburg institute of forestry sends a collection of wooden implements from the peasantry, and the government of Kazan has a collection suggestive of the apiarian industries of that section of the empire.

Adjoining the New South Wales section, Mexico shows her woods, roots, fibres, dye-stuffs, and medicinal products. Four hundred different species of native woods are here displayed in the 2,000 polished specimens contained in a simple, rustic pavilion, its square main entrance, composed of disks, presenting a unique appearance. Resins, vegetable wax, copals, such as are used in the manufacture of varnish, and chewing gums, add variety and interest to the exhibit.



CARVED DOOR OF TEAK WOOD



LOGGING TRAIN

Tocantins, a tributary of the Amazon, a separate structure within the pavilion being composed of specimens from the forests of the great river. Among the collection are also samples of inlaid wood-work and basket-work.

Of somewhat similar character are the exhibits of the Argentine Republic and Paraguay, each having some 300 varieties of wood and many medicinal plants. In the Argentinian section is a crocodile dragging its unwieldy frame over a mahogany stump. The main collection of woods is in the form of a truncated pyramid, surmounted by an octagonal block of fragrant cedar.

Crossing the central nave we come to the exhibits of Spain, the Philippine Islands, and Cuba, the features in which are the huge square timbers of Cuban mahogany, and the Spanish collection of native woods and corks. Close to the northern portal of the Forestry hall is an enclosure surrounded by a high bamboo fence, within which are the choicest of Japanese forest products. A special effort is made to show the adaptability of the woods to receive a hard finish, and the delicacy of their graining. A rough, brown piece of wood, labelled cinnamora camphora, is a specimen of the tree from the roots of which the camphor of commerce is manufactured. There are also such articles as bamboo, rattan, and lacquer ware, sago-palm baskets, wooden water-pipe, palm-ropes, charcoal, seeds, sap, nuts, and sections of trees, great and small.



LARGEST LOAD OF LOGS EVER DRAWN BY ONE TEAM



MICHIGAN LOGGING CAMP

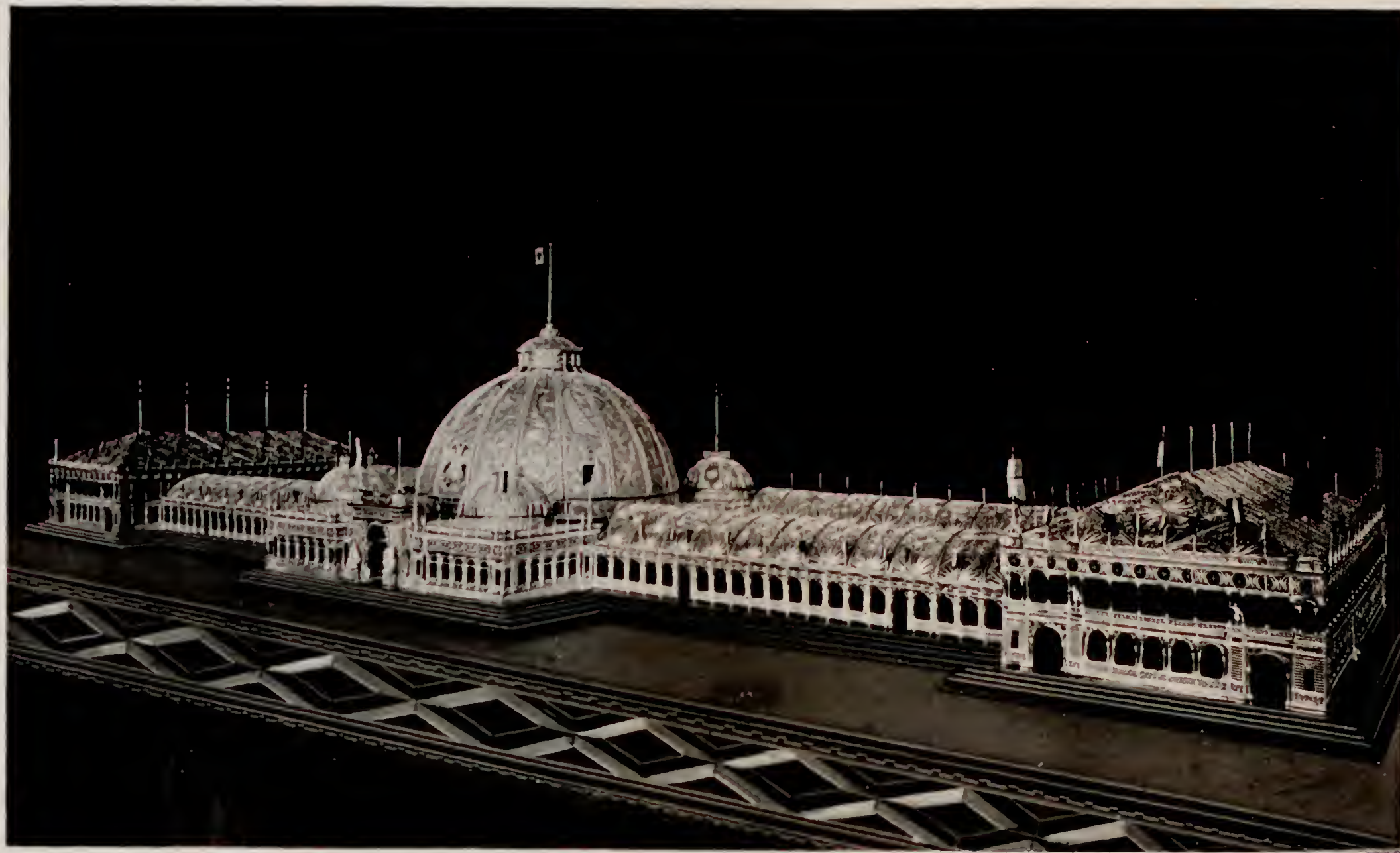
Brazil, the Argentine Republic, and Paraguay have remarkable collections of the woods used for ornamental purposes, together with barks, dyes, and medicinal herbs. The first has a large pavilion fashioned from small trunks and interlacing limbs, its main entrance in the form of an archway of Gothic architecture. Mahogany is a prominent feature, for this is one of the most valuable of Brazilian woods. Perhaps the finest of the cabinet woods are from the banks of the

The national department of agriculture and commerce sends a collective exhibit, comprising timber and planks, cabinet, ornamental, and fossil woods, barks and galls for tanning and dyeing, vegetable wax and resins, wood pulp for paper, and maps, plans, and illustrations of forest management. Colored pictures of various trees and flowers are shown, and upon the outer walls of the pavilion are depicted in graphic art wild scenes of the mountain forests.

Adjoining this, in the north-western corner of the hall, is the Indian exhibit, where a British trading corporation displays samples of teak flooring and wood paving, railway wheel blocks, and specimens of fabrics dyed with catch. Elsewhere are planks and slabs of vermilion and

padouk, and a large door made of teak, the original of which is in the royal palace of Mandalay, Burmah. Upon it are scores of carved figures and architectural forms, representing the city, the king, queen, ministers, and the guardian spirit of the municipality, with other mythological characters.

Embedded among the individual and state exhibits are those of Siam and Trinidad, the latter with samples of rich red purple heart, of balsam, mangrove, guava, redwood, Spanish ash, and bamboos, in many sizes, together with specimens of what has been accomplished in several lines of manufacture. In Siam's collection, diagonally opposite from that of California, are more than 200 specimens of native woods, some of the smaller varieties in the form of baskets and rustic stands. The lordly teak is king of all, one solid slab, highly polished, being nine feet long, and six in breadth. Large sections of the taback and tamarind are also among the evidences of the forest wealth of Siam.



MODEL IN SILVER OF THE HORTICULTURAL BUILDING

WORLD'S FAIR MISCELLANY.—Adjacent to the Horticultural building are propagating houses and frames, where space is assigned to exhibitors for growing valuable plants such as will not bear transportation. Here also are illustrated modern improvements in construction; a Swiss inventor, for instance, erecting a green-house of glass bricks which he claims to be proof against cold, hail, and other destructive agencies, while others show their systems of steam heating, ventilation, etc. A considerable area is also used for replacing faded or injured specimens.

Both for heating and sprinkling ample provision was made. For the former purpose there were three boilers, each of 150 horse-power, and an elaborate system of engines, fans, and steam pipes, by which the temperature of the dome and the front curtains of the hall were adapted to the most delicate of tropical plants.

Near where the Midway plaisance joins Jackson park are the nurseries for the propagation of trees and berries. A large plot on the northern side of the avenue is planted in California oranges, lemons, figs, apricots, peaches, prunes, grapes, etc., and on the opposite side France shows her careful and scientific methods of raising pears, peaches, grapes, and other fruits. There is also a large collection of evergreens in this locality, with a Wisconsin cranberry bog, showing all the processes of flooding, draining, and

cultivating. Mexico has a section filled with characteristic plants; New York demonstrates how she would train grape vines, and a firm which manufactures nitrate of soda produces vigorous plants, nourished and stimulated by this fertilizer, side by side with others which, for want of it, appear as though sick unto death. In one corner of the nurseries is a mass of rank vegetation over which is a sign with the inscription, "What to Hit with the Hoe." Here are 125 varieties of weeds in actual growth, the exhibit being organized by a leading agricultural journal.



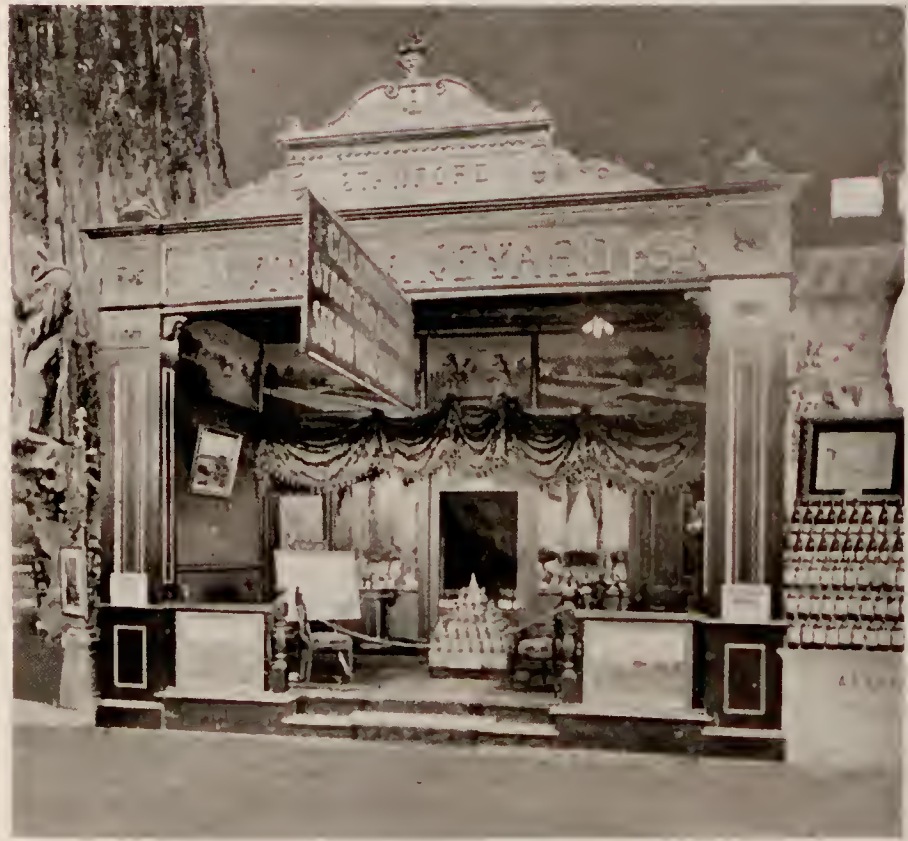
IDAHO EXHIBIT



There is also a large collection of evergreens in this locality, with a Wisconsin cranberry bog, showing all the processes of flooding, draining, and

Among the curiosities of Agricultural hall are the American fly trap and the California pitcher plant. The leaves of the former are furnished with slender, comb-like teeth, the upper surface being set with slender hairs which are extremely sensitive. When touched they contract and draw the leaf together like a book, entrapping the fly and holding it fast as long as it is able to move; when the insect

is dead and motionless, the leaf unfolds. The lower portion of the pitcher plant is set with long bristles, inclined downward, like a certain kind of patented mouse-trap. Thus the unwary insect falls into the water with which the pitcher is partially filled.



CALIFORNIA WINES

To foreign countries was assigned about one-third of the entire space in Horticultural hall, and so great was the interest aroused that they would have taken the entire area had they been permitted. The first exhibit was received in the winter of 1892 from New South Wales, whose wines also received in midwinter were frozen and spoiled, but promptly replaced by other specimens.

Except for wood-pulp the Forestry exhibits contain no completely manufactured articles, though there are many in various

stages of manufacture. In showing the structure and commercial value of woods, the usual method was to cut them into transverse, radial, and oblique sections, showing the heart and outer portions of the tree, leaving one-half of the specimen in its natural state, and polishing the remainder. There are also barks, gums, resins, and turpentine; lichens, mosses, and substances used for bedding and upholstering; specimens of herbs and roots having medicinal properties, and cork, both in rough sections, and partially manufactured. As a rule the states exhibit the wealth of their forests in their crude condition, while individuals display material in shapes which fall just short of manufactured products.

Not far from Machinery hall, Michigan has a typical loggers'

camp. Everything is built of logs, even to the large chimneys of the cabin. In and around the building are specimens of all the tools used by Michigan lumbermen, from the opening of the first camp down to the present time. The dining room is remarkably neat, as also are the bunks, with their frames made of tree limbs. Side-tracked near the model is a lumber car, piled high with huge logs. The load weighs nearly 290,000 pounds, contains more than 36,000 feet of lumber, and before being delivered to the railroad in Michigan, was drawn on a sleigh for a distance of a quarter of a mile by a single span of horses.

California's exhibit in the Forestry building is a forcible reminder of the wonders of forest life on the Pacific coast. Attention first centres in the *sequoia gigantea*, as is called the king of all the big trees which have made California famous. They attain a height of 300 to 350 feet, and are the tallest conifers in the world, averaging fully twenty-five feet in diameter.

New South Wales and Mexico each claim to have within their domain the largest tree in the world. The Australian giant, a species of fig tree, is 485 feet high. Through the president of her commission, Mexico asserted that in the state of Oaxaca there was a tree of the leguminous species 53 feet in diameter, and while its height had not been ascertained, it was undoubtedly the king of the vegetable world. It has been christened Santa Maria del Tule.

Besides having one of the largest displays in the building, Missouri contributed to the colonnade of trunks which surrounds it, specimens of yellow pine, oak, red oak, cypress, hickory, red gum, and ash. According to state authorities, the counties lying along the Mississippi river might have furnished much larger samples than those presented at the Fair. Nevertheless they are large enough to impress the visitor with the commercial value of timber trees which, not many years ago, were viewed simply as impediments to the agricultural advancement of the state.

Of the western states perhaps Minnesota has aroused more general interest on the subject of forestry than any other, realizing, as she does, the evils resulting from the denudation of her timber tracts. Here it is well understood that aside from increasing the beauties of the state, arboriculture equalizes the temperature and rainfall, breaks the force of wind and flood, supplies material for fuel and fencing, and furnishes an ultimate supply of timber which must become most valuable if the natural wealth of the state continues to be drained away.

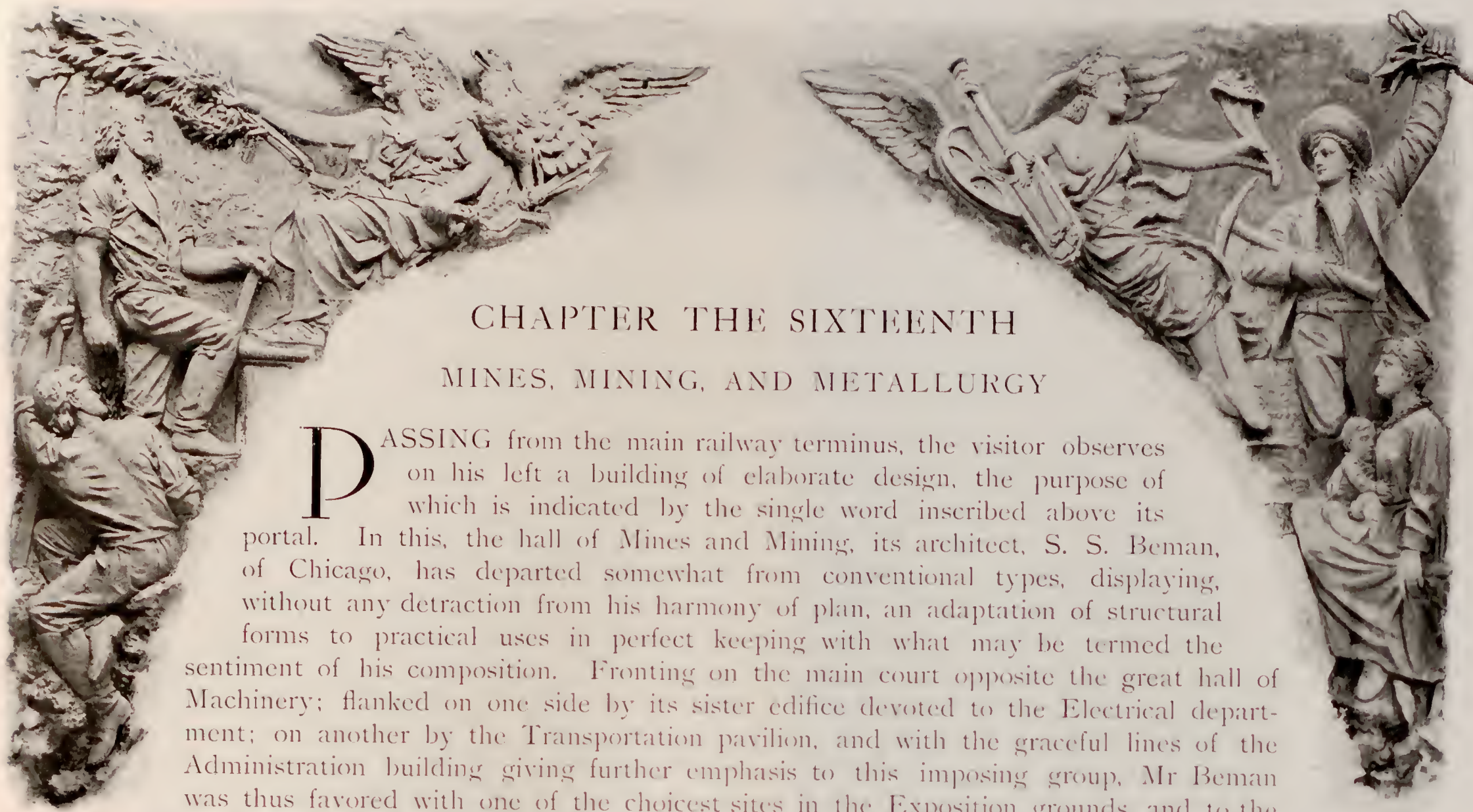


"POMONA"





A BIRD'S EYE VIEW



CHAPTER THE SIXTEENTH

MINES, MINING, AND METALLURGY

PASSING from the main railway terminus, the visitor observes on his left a building of elaborate design, the purpose of which is indicated by the single word inscribed above its portal. In this, the hall of Mines and Mining, its architect, S. S. Beman, of Chicago, has departed somewhat from conventional types, displaying, without any detracting from his harmony of plan, an adaptation of structural forms to practical uses in perfect keeping with what may be termed the sentiment of his composition. Fronting on the main court opposite the great hall of Machinery; flanked on one side by its sister edifice devoted to the Electrical department; on another by the Transportation pavilion, and with the graceful lines of the Administration building giving further emphasis to this imposing group, Mr Beman was thus favored with one of the choicest sites in the Exposition grounds, and to the best advantage has he improved his opportunity.

First of all it may be observed that in studying his design the artificer must prepare for the housing of a large and bulky display of ores and minerals, of mining and metallurgical machinery and appliances, many of them requiring a liberal proportion of floor room and height. Hence, in this building, and especially in its central nave, it was necessary to avoid, as far as possible, all columnar obstructions, leaving unencumbered the greatest available area for the reception of exhibits. Of the space at his disposal, including with galleries somewhat less than nine acres, a large portion was devoted to a nave 630 feet long, in its centre a circular court from which the main avenues radiate, and where is a design typical of mining industries. In all this spacious nave there are only sixteen pillars, eight on either side, and on which rests the system of cantilever trusses that support a lowered roof, fashioned largely of glass, and at its highest point nearly 100 feet from the floor. The aisles, which divide the building into four main sections, are similarly treated, and with their columns anchored against the inner rows. Thus is relieved the comparative depression of the curtain walls, whose height from ground to cornice is little more than sixty feet.

A further accentuation is given by the principal entrances, one in the centre of each of the four sides, those on the north and south 80 feet wide, with richly decorated cornices, and flanked by pilasters, on which rest banner staves, their flags imparting to the outline somewhat of a holiday appearance, and modifying the serious aspect of the design. Around all the entrances are monuments, designs, and figures in keeping with the exhibits contained within. At the corners are square pavilions, lighted by arched windows on either face, and with low domical roofs crowned with circular lanterns. Between these pavilions and the main portals are piazzas 25 feet wide, with coffered ceilings, and from which there is access to the interior at several points. From either side of the entrance-halls broad stairways lead to windowed galleries, 60 feet wide, and affording an additional floor space of more than 100,000 square feet. Thence, from numerous openings, the visitor may step forth into recessed balconies, from portions of which is an excellent view of the structures and grounds adjacent.

In the elaboration of his design the architect has not adopted any special order of architecture, for in doing so he could not have given to his scheme an architectural expression in conformity with the character of the exhibits. The façades are of modern style; the roof planned somewhat after the fashion of those which cover the car-building sheds of the Pullman company. Elsewhere, and especially in the entablatures, are traces



MINING EXHIBITS FROM THE GALLERY

of Italian detail, mingled with that of the French renaissance, while in the loggias and balconies the treatment savors of the Doric and the earlier Romanesque. Finally it may be said that, whether from an architectural or utilitarian point of view, the hall of Mines and Mining does not suffer by comparison with its more imposing neighbors.

As with the Fisheries and several other departments, this is the first of our great world's fairs at which mining has been placed on an equality with manufactures, agriculture, and all the more prominent industrial pursuits, and its exhibits ranked on a par with any, and housed in a building of their own. At the London and Paris expositions all such specimens were classed in a single group, to which was granted but a meagre allotment of space; and even at our own Centennial Exposition they were pushed aside into an annex of the industrial edifice. Here, however, due prominence is given to an industry which in value of production ranks third among those of the United States, many of its branches, before incorporated in other divisions, for the first time receiving in their proper place a fitting and adequate representation.

Says the chief of this department, referring to the scope and character of the exhibits: "They will cover the entire range of the mineral kingdom. They will include minerals of every kind, ores, native metals, gems, and crystals; geological specimens; coal, coke, petroleum, natural gas, building stones, and quarry products;

graphite, limestone, cement, and artificial stone; salts, sulphur, fertilizers, and mineral waters; the long catalogue of iron and steel, and of tin, and the new metal, aluminium; the extraction of gold, silver, and lead by various methods; mining machinery, tools, and appliances; literature, models, and reproductions. When we consider the wealth represented by the quarries of New York and the New England states, the coal and iron of the Alleghanies, the phosphates of Florida and the Gulf, the oil and gas of Pennsylvania and Ohio, the copper of Lake Superior and the tin of the Black hills, the silver and lead of the Rocky mountains and the gold of California; with the immense manufacturing interests connected with the production and manipulation of our country's vast mineral wealth, remembering that there come into competition with her all countries and quarters of the globe, the varied and exceptional character of the mines and mining display will be appreciated."

On entering the hall which contains these exhibits, the first question the visitor asks himself is "How did they get here? How were these mammoth specimens collected and transported from every quarter to be placed in congruous and symmetrical groups under the roof of a single edifice?" Perhaps in no time or place but the present could they have been got together; for years of persistent solicitation and careful planning were required before the more bulky articles were rolled



MODEL OF COAL MINING MACHINERY



INTERIOR OF MINING BUILDING



PENNSYLVANIA BRICK AND TILING

on cars to the principal entrance way, to be lifted by cranes and moved on trucks into position. From the spacious central nave, sometimes termed Bullion boulevard, extend eastward the state and territorial pavilions or structural façades in metals or minerals, beyond which is the mining machinery; while to the west our foreign friends show what their several countries can produce. Among United States exhibits Montana's silver statue, Pennsylvania's needle of anthracite coal, and the geological obelisk of the empire state attract much attention. Among those of other lands may here be mentioned the elaborate collections of Germany, Mexico,



EXHIBIT OF THE EMPIRE STATE

Canada, and New South Wales, and the diamonds which in the spectators' presence are washed by Kaffirs out of the blue earth imported from Kimberley mines.

On the gallery floor the largest of the individual exhibits are those of the Standard Oil company, and the Frick Coke company, the former displaying the several methods used in the production and distribution of oil, and the latter a model of their plant. Of scientific interest are the metallurgical displays arranged by the chief of the Mining department, and the collections of the Ward Natural Science establishment. In a series of courts are arranged in related groups all mineral substances of industrial, economic, or scientific value, with an assaying department in actual operation. Nor should mention be omitted of the library, catalogued for public use, and containing histories and statistics of mines and mining districts, with numerous charts and diagrams, together with maps and models illustrating the geological formation and distribution of mineral veins, and the modes by which they are worked. To the mining engineer or surveyor the collection is especially valuable, for here are treatises on every branch of his profession, including among others the location of shafts



MINING BUILDING, NORTH FRONT



PLUMBAGO, NEW YORK SECTION

and tunnels, their sinking or boring and timbering, the sloping and hoisting of ore, and the drainage, lighting, and ventilation of mines. Finally, the visitor may compare the present with ancient methods, for there are some of the earliest apparatus used in mining and metallurgy, either as originals or reproductions.

Coal and iron are treated in broad lines; for in the United States these industries represent the investment of hundreds of millions of capital and afford employment to hundreds of thousands of men. Of bituminous coal the annual yield exceeds 100,000,000 tons; of anthracite nearly half as much, and of pig iron about 10,000,000 tons; the total value of their output, the two first as delivered at the mines being estimated at more than \$300,000,000. Next in order of value, or very nearly so, are silver, building stones, copper, lime, gold, petroleum, natural gas, lead, and zinc, these and other metals and minerals increasing the total production to about \$650,000,000 a year. In the exhibits contained in the Mining hall, quality rather than quantity is the feature of the display; and here the visitor may learn more in this connection than years of travel could teach him. In the coal collections for instance, are not only the varieties produced in different regions, but with many of the specimens are chemical analyses, and the results of tests whereby have been demonstrated their economic value and adaptability to special uses, with geological

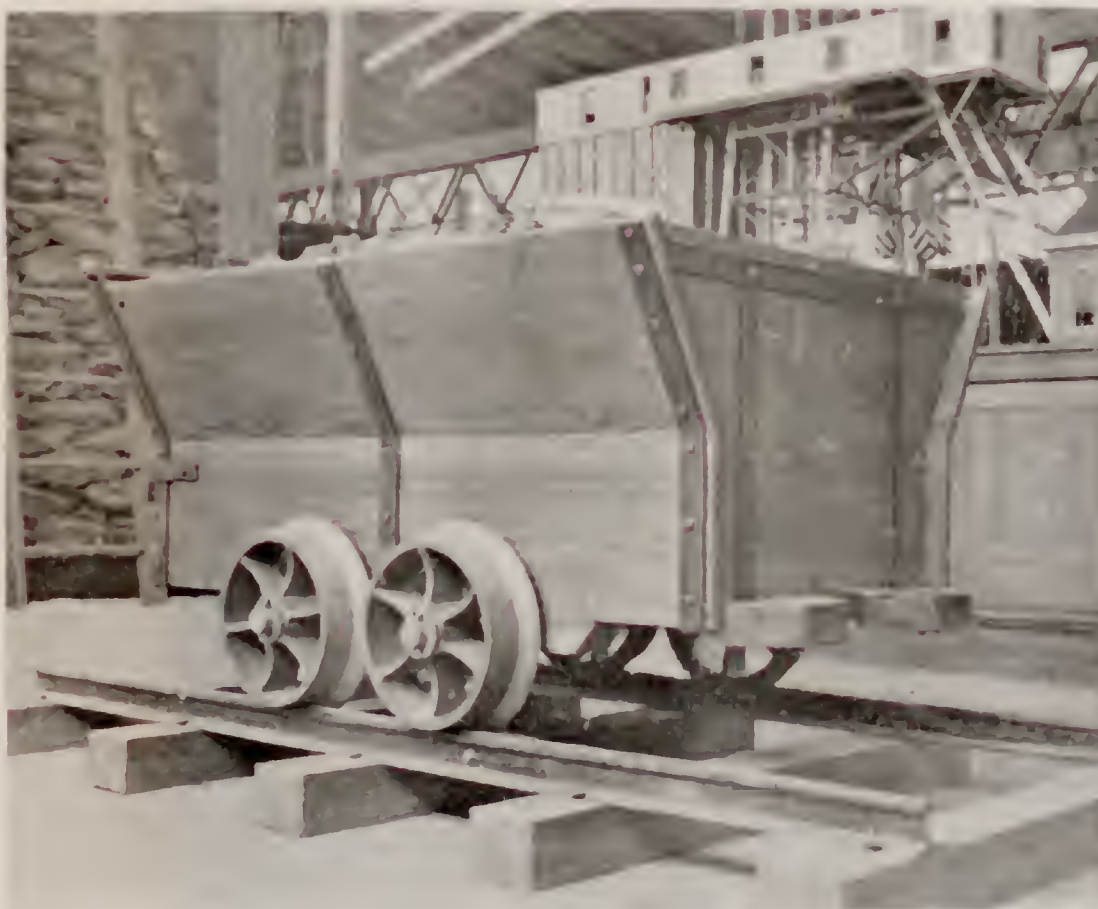
and other maps and drawings showing stratification, extent, locality, accessibility, and other valuable data. And so with iron and other products, all the groups being arranged and illustrated with special reference to the industries which they represent.

Near the northern portal of the hall, flanked on either side by the pavilions of France and Pennsylvania, is a lofty monument fashioned of cubes, which gradually decrease in size almost to a point. Those at the base are of massive proportions, and on several of them are inscribed the words anthracite, limestone, natural gas, petroleum, iron ore, and granite. Then come salt and other minerals produced in the United States, nearly all of commercial value having a place in the column. In these cubes are represented the proportionate bulk of all the minerals which come from the mines and quarries of this country during one second of time, asbestos forming its tip, gold ore second, and silver ore only a few removes from the top.

Within the entrance of Pennsylvania's pavilion are displayed her petroleum and petroleum products in hundreds of glass bottles contained in neatly finished show-cases. Facing them is a large relief map of the state, representing the location of her principal coal and iron mines, her oil and natural gas deposits, blast furnaces, pipe systems, and railroads. In a small pavilion are shown the various uses of slate, as for pillars, roofing, walls, and black-boards. On the western side are exhibited in the form of truncated pyramids, grouped in rectangular shape, all the varieties of anthracite, with commercial samples and analyses, while at the corners of the rectangle are samples of bituminous coal. A colored drawing illustrates the manufacture of zinc oxide and spiegeleisen, the latter largely used for the manufacture of Bessemer steel. In bricks and other samples, crude and burned, are shown the many varieties of fire clay found in Pennsylvania, and next to these are tile clays in every form. There are also more than 100 specimens of building stones, with glass sands, the mixtures used for various kinds of glass, and the finished product. Soapstone, nickel, manganese, iron ores, and the several stages in the manufacture of iron, with the charcoal, anthracite, bituminous coal, and coke used for such purposes, are also on exposition.

An interesting exhibit is a complete working model of a coal mine, with engines and the work they do, from hauling coal up the incline until it is dumped into the screens and there assorted into sizes and loaded into railroad cars. Near by is a primitive iron furnace, of a pattern more than 1,000 years old, and grouped about it are rude implements such as Tubal Cain might have used. On the walls are photographs, charts, and maps of geological and mineralogical surveys, with relief maps and other illustrations.

But the most attractive feature is in the central court of the Mining hall, where is the shaft or so-called needle of anthracite already mentioned. This trophy is fashioned of solid blocks of that mineral, extracted from



COAL CAR FOR MINING

the Mammoth mine of the Lehigh Valley Coal company. It is more than 50 feet high, weighs nearly 100 tons, and to mine and place it in position was the task of many weeks, involving an outlay of several thousand dollars. The entire collection from Pennsylvania is gathered and arranged as a utilitarian rather than an ornamental display, and shows to excellent advantage her rich and manifold resources.

The exhibits of the empire state are also of a substantial character, with no attempt at ornamentation except for the pavilion which contains them, and a pagoda of terra cotta in one of its corners. The former is in the shape of a rectangular colonnade, the entablature resting on Ionic arches springing from pillars of uniform design, and the corners surmounted with handsome balustrades. The cornices and frieze are decorated with sculptured tablets, and the spandrels between the arches are ornamented with representations in relief of

mining scenes and implements. In front is an obelisk constructed of rocks in the order of geological succession, the device of the geologist James Hall. Here it may be mentioned that, apart from local collections, this is the only complete exposition that New York has ever attempted of her geological formation and mineral resources, though in this state is found the keynote to the geology of a vast adjacent region.

Among the exhibits are samples of all building, ornamental, and other stones of commercial value, of which the state possesses an abundant store. There are likewise specimens of the solid crystalline salt deposits peculiar to her soil, with clays, gypsum, sands, and shale, the first including kaolin, and displayed in raw and manufactured forms, together with mineral paints, iron ores, and petroleum. A feature in the collection is the beautiful specimens of quartz and fluorite, and on the gallery floor is a large



A MODEL DISPLAY

assortment of precious stones and minerals contributed by a New York jewelry firm.

Adjoining the New York section on the east is the New Jersey pavilion, the greater portion of which is devoted to an exposition of her geology, illustrated by a large relief map. Along the walls are cabinet specimens of ores, building stones, and potters' clay, in the last of which the state is especially rich. Her production of zinc is somewhat remarkable; and here the information is conveyed that of the 1,000,000 tons of ore produced in the United States since 1873, 719,000 were contributed by New Jersey.

Either in the western galleries among the metallurgical groups, or in the eastern galleries among the specimens of building stone, all the New England states are represented with the exception of Rhode Island. From the Colby university of Waterville, Maine; from the Portland society of natural history, and various private sources, are collections of minerals and gems, a quarry company contributing a large urn of polished granite and a variety of smaller specimens. Harvard college sends to the Massachusetts section many rare fossils, large slabs of stone showing the foot-prints of some mammoth of the antideluvian era. Granite and marble, gneiss and hornblende, corundum, emery, and graphite, with an abundance of ores and gems, virtually complete the collection of the old Bay state.

New Hampshire, Vermont, and Connecticut display their granites and marbles in the eastern galleries. In the New Hampshire collection are many specimens of mica, and pillars and a massive table are constructed of the stone for which that state is famous. The granites of Connecticut, principally gray and red, are also the prominent feature of her section. Vermont, while showing several beautiful varieties of granite, upholds her reputation as the producer of some of the best marbles from the quarries of the United States, the specimens being displayed



SECTION OF MINERAL CABINET

in a circular portico of Grecian architecture. Many of the cases within contain cubes of the best known American varieties, and the famous marble quarries of Rutland contribute largely to the general effect.

One of the most interesting and unique of the scores of pavilion elevations in the Mining hall is that of Kentucky, in the background of which is depicted the entrance to her mammoth cave, while beneath it is reproduced a section of the cave, to which a trap-door affords access. The facade is a temple-like structure



GENERAL VIEW DEPARTMENT OF MINING

of Gothic architecture, and, together with the wide open archway in the centre, is built of cannel coal, its effect increased by contrast with the white marble edifice of the empire state. Its plan was suggested by the portal of the Virginia Military institute in Stonewall Jackson's native town. While consisting largely of coal, as might be expected from a region with 14,000 square miles of bituminous coal deposits, and with a yearly output of more than 3,000,000 tons, the exhibits of Kentucky are as varied as her resources, and include marble and other valuable stones, tile-clay, copper, iron, gold, and silver, all displayed as minerals, ores, or metals to the best advantage.

Ohio's section is enclosed by a handsome colonnade, constructed entirely of minerals found within her borders, and intended to present in picturesque form her resources in that direction. One of the passage-ways is fashioned of tiles, and extending over the entire length of the floor space at the northern end are alcoves containing specimens of quartz. In show-cases are mining and mineral samples, and in the centre are models illustrating the manufacture of table salt and the machinery used for pumping oil from Lima's productive wells. In the galleries Ohio is well represented in the metallurgical exhibits organized by Frederick J. V. Skiff, the chief of the Mining department, and here also are several collections from her university and colleges of agriculture and the mechanic arts.

Representing as they do one of the most prolific districts in the production of building stone, the exhibits of Indiana, both in the construction of her pavilion and its contents, are somewhat of a uniform character. The four granite pillars which support the entrance harmonize in coloring with the whitish grey of the limestone, the latter a prominent factor in the mineral wealth of the state. The quarries at Bedford are especially noted, and thence were gathered the bulk of the limestone specimens ranged along the centre of the section. Opposite are large blocks of coal, for which Indiana is famed, both as to quantity and quality of output. Elsewhere are cabinet specimens of building stone, and samples of petroleum oil, brick, tiling, and other clay products, while near the western entrance to the Mining hall is a stately pillar of oolitic limestone from Bedford deposits.

Michigan occupies a place of honor, fronting on the central court, and with the largest space allotted to any of the state exhibits. Among the materials used for her pavilion are specimens of building and ornamental stones, with other minerals taken from Michigan mines and quarries. The archway is of native sandstone, its dome-like interior lined with copper, on which are displayed the mineral products of the state fashioned in the form of shields, with the coat of arms on medallions, and above all an allegorical group representing two miners whom the presiding genius of that industry is crowning with wreaths of laurel.

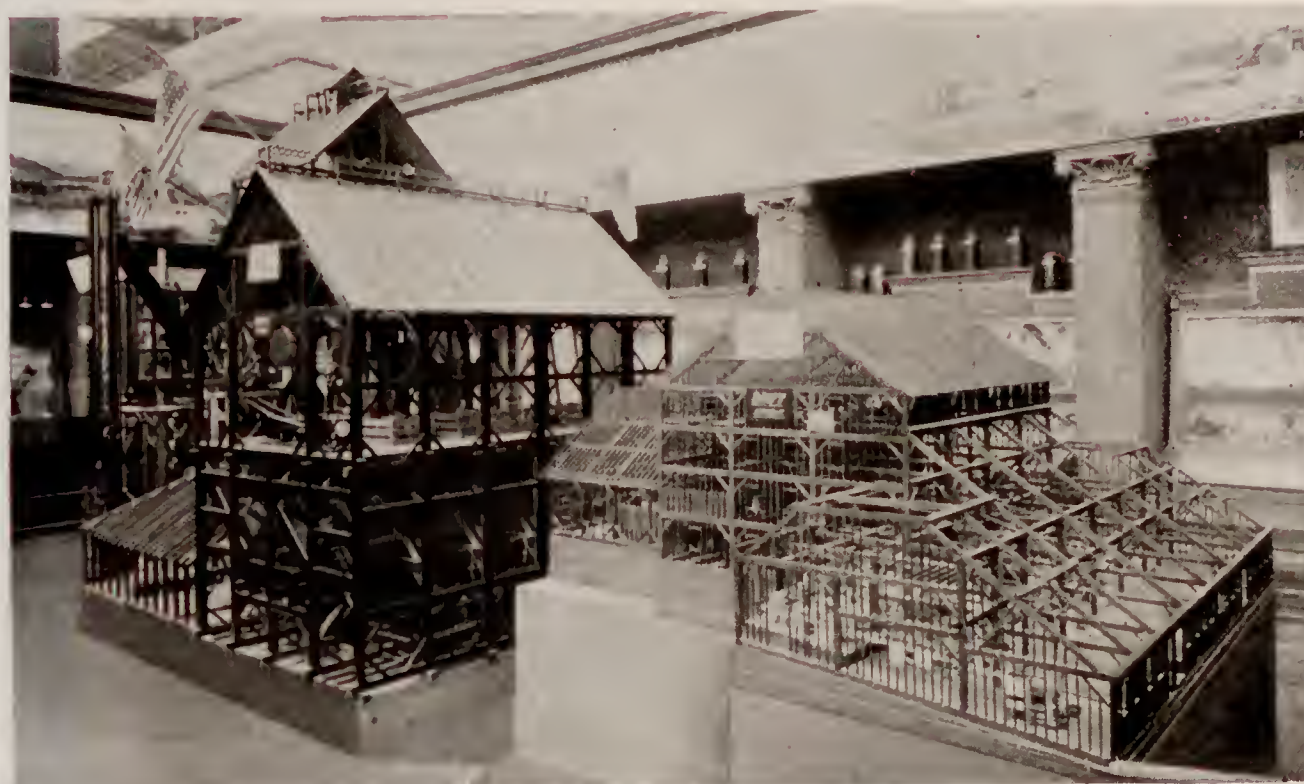
Fronting on the central nave is a large diagram showing a cross section of a mine operated by the Cleveland Cliffs Iron company, and representing its geological formations, with the system of shafts sunk to three successive levels before the ore body is reached. On two of the interior walls are pictures of the more prominent mines in the upper peninsula, as the Pittsburg, Barnum, and Salisbury, around which are heaps of timbers and snow-covered piles of ore. The famous Calumet and Hecla mines, and the stone quarries of Marquette, are also reproduced in graphic art; and among scenic views are those of Lake Angeline



A COPPER MONSTER

before its waters were drawn off, and of Todd's harbor and Isle Royal. One of the exhibiting companies shows the levels of its mine in sheets of glass on which are indicated the locations of drifts and tunnels, while elsewhere are models of machinery, mills, and reduction works.

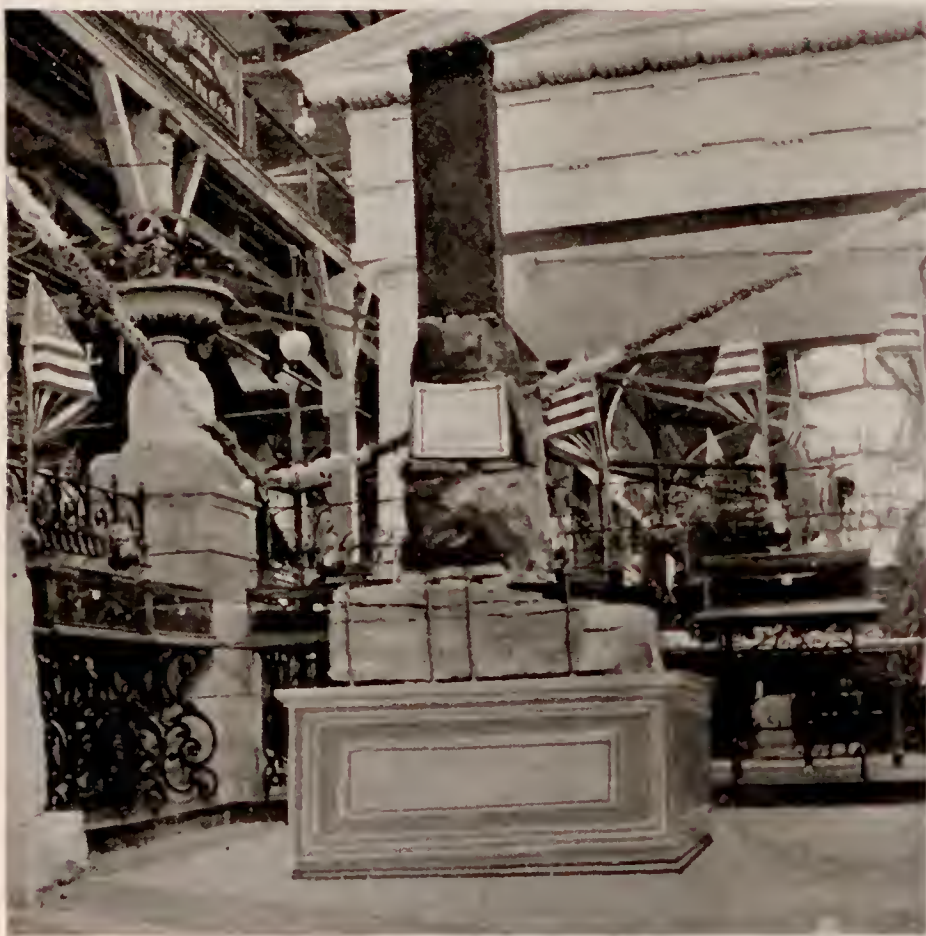
Michigan's display of minerals is both interesting and instructive; including specimens of the richest iron ore found within the state. There are samples of gold ore found near Ishpeming, assaying \$10,000 to the ton,



MODEL OF MICHIGAN MINING BUILDING

with silver ores, marble of different kinds and colors, verde antique and serpentine, and granite and whetstones. These specimens are for the most part taken from private collections, as are also graphite, fire and common clay, fire sand, coal, amethyst, agate, and chlorastrolites, the last a beautiful mineral, and found only in Spain and on Isle Royal in Michigan. Among other samples here displayed in profusion may be mentioned red analcimes, abophyllites, preahnites, dalholites, stilbites, dolomites, and calcites. Then there are pipe ores, kidney ores, needle iron ore, grape ores, epidotes, and calcite crystals, containing native copper, yet indeed representing but a tithe of the more valuable and useful portion of the collection.

But copper is the main feature in the Michigan section, and in truth the display is a generous one, including native copper, copper ingots, bars, sheets, cakes, and wires; rag, nail and fan copper; ores, conglomerates, and amygdaloids; battery and tailing samples, and copper in what other forms soever it is found or fashioned. The largest mass is of native copper, weighing 8,500 pounds, with others almost as bulky, composed of the richest of ores and conglomerates. In the centre of the pavilion are two mounds of copper, one constructed of wire, at the base of which are sections welded by an electrical process whereby wires can be produced of indefinite length.



FROM THE FAMOUS PIPESTONE QUARRIES

Among the more curious exhibits are prehistoric tools found in the mines, fashioned of native copper, and in the form of knives, spear and arrow heads, adzes, and hammers. These are among the state contributions; and no one can tell how they were made, for the metal is hardened and tempered by a process which modern scientists and mechanics have failed as yet to discover. As to this process it can only be said that thousands of inventors have tried in vain to reproduce it, and that to the aborigines of the Lake Superior region was known what is now a lost art, whereby weapons and tools were made such as cannot be duplicated by the most improved of modern methods. Says the official in charge of this exhibit: "It is claimed by several that tempered copper is now being placed on the market; but if the art is ever to be discovered, it has not been achieved so far. I have heard of men who have seen weapons or tools of the aborigines that would turn the edge of a steel chisel or dull a file."

The state which contains the home of the Fair reserves her strength for the machinery department in the Mining hall, and is mentioned in that connection. In Wisconsin's collection are fully illustrated her abundant mineral resources.

Shafts of polished red marble support the arch above the entrance way; at the corners are monoliths of sandstone, and within is a temple-like structure, its dome upheld by fluted columns with Doric capitals. The floor is of black and white tiling, and the materials for the outside walls were furnished from Bayfield quarries. In the centre of the pavilion is a pagoda, at the corners of which are bars of lead and piles of iron, zinc, and galena ores. In pyramids and other forms are all the economic minerals and metals of Wisconsin, in raw or manufactured forms, including marble and granite; bricks, tiles, and terra cotta; jasper and serpentine; iron, copper, zinc, and lead; brown hematite of ochre, mineral paints, and the sands that are used for the making of glass. From Milwaukee are specimens of the so-called Wisconsin pearls, and from not a few of the exhibitors are entire cabinets of specimens, for many counties have contributed to the display.

Minnesota's home in the Mining hall is east of the Ohio section, her booth partially enclosed by a bronze fence of scroll-work, and the entrance-way of building stone from her principal quarries. Within is a remarkable display for a state that has but recently attempted mining on any considerable scale. Her principal exhibits are of iron, large contributions coming from the region tributary to Duluth, and including a great variety of specimens. About thirty companies are represented, and the samples shown by each contain not less than 63 per cent of metal, while several show nearly 70 per cent, a remarkable average considering the extent of territory from which they were taken.

Of iron ores there are many exhibitors, including a carefully selected group of specimens. Of building stones there is a special contribution containing 100 varieties, with samples of bricks and the clays from which they were made. From Duluth is a fine specimen



ORES OF WISCONSIN

of Lake Superior amethyst weighing 300 pounds. A group of jasper shows the highly polished quartz; another is in the rough, and a third consists of carved figures from stone of a reddish hue. From Sioux valley is also a handsome shaft of jasper polished by hand. Granite is well represented, especially in a pillar and shaft of this material, the latter of the speckled variety from Rockville. There is slate from Cloquet, brown stone from Duluth, and other varieties from various parts of the state. A unique structure is in the form of a mound, its base of Indian pipestone, upon which is a layer of jasper, then several feet of earth, with the greensward for a covering. The lower portion of the mound was quarried from the red pipestone quarries on the national reservation in Minnesota, near Pipe Stone City, and said to be the only quarry of its kind in the world. Since time immemorial the American aborigines have used this substance for their peace-pipes which Longfellow has described in his *Hiawatha*.

Among other features of interest is a model of the Chandler mine at Ely, showing the shaft houses, tools, and mining apparatus, as well as the geographical formation and the different levels, with the process of mining, hoisting, and timbering, and with miners carrying lanterns on their heads. Arranged along the inner walls are charts illustrating the geological survey of the state, while a large map shows the underground plan of the Minnesota mines at Soudan.

Beneath the stairway at the southern end of the Mining hall are the coal pillars of the Iowa pavilion, to which an ornate appearance is given by the judicious use of colored clays and sands. Within are mounds of iron, lead, and zinc, a miniature grotto constructed of material gathered from the caves of Dubuque county, and the display of a Centerville coal company, consisting of models of its works and cars, installed upon a platform of coal. There is also shown the interior of a coal mine, with full-sized figures of miners at work, and a truck filled with coal on the track ready to be hauled to the surface. The depth is only twenty-five feet, but by an ingenious device appearing as though it were several hundred feet. The mouth of the pit, over which are the words Iowa Black Diamond Hollow, is surrounded with solid blocks of coal. Adjoining the pavilion proper are cabinets of economic minerals, and a small section in which are shown by a marble company specimens of its stone in raw and manufactured forms.

To Missouri was assigned one of the four sections around the central court, where also are the exhibits of Michigan, Germany, and Great Britain. Her tasteful pavilion, with its handsome portal and colonnade, its decorated frieze and balustrade, is composed almost entirely of materials furnished by the state. The base is of granite from the syenite quarries of southeastern Missouri, the walls of brick from St Louis county, and the pillars, capitals, and frieze are of terra cotta. At the principal entrance-way are panels of onyx, and the coat of arms above it is surmounted by an eagle, with garlands depending from the shoulders of cupids.

Within this structure are worthily represented the resources of a state which in 1892 produced more than 3,000,000 tons of coal, 131,000 tons of iron ore, of zinc ore almost as much, and 32,000 tons of lead; her yield of these metals for the year being estimated at \$9,100,000, and the entire output up to that date at \$178,000,000. On tables and in glass-covered show-cases of polished oak are countless labelled specimens, with photographs and models indicating mineral localities and features, and with mineral production and distribution displayed in chart and diagram form. In the centre of the pavilion is a large relief map showing the areas and locations of all the principal deposits of economic minerals. The value of the entire display is further increased by its

methodical arrangement, with inscriptions and labels for the various groups of products, and for each of the specimens of which the groups are composed.

While coal, iron, lead, and zinc form the bulk of the display, there are numerous specimens of other metals and minerals, including copper and silver ores; blendes of various kinds; calcites, calamites, dolomites,



SECTION OF MISSOURI PAVILION



SOUTHWESTERN ZINC

and siegenites; ochres, glass-sand, clays, and bricks; sandstone, limestone, marble, and granite. Zinc is a special feature in the collection, as befits a state which produces more than one-half of the entire output of the United States. Some of the specimens are remarkable for range and brilliance of coloring; their shades varying, from black to a lightish yellow, while colorless crystals are arranged in tasteful groupings. The mineral is displayed in every shape, beginning with the crude ore as it comes from the mine, and displaying each successive stage up to the completed product in all its commercial forms. Lead is similarly treated, and near a table on which is a 1650-pound mass of zinc ore is a group of nearly perfect cubes of galena weighing 500 pounds, and almost entirely of pure lead from the Joplin mines. In the centre of this section is a pedestal of solid metal formed of specimens from various smelting works throughout the state. At the southeast corner



MISSOURI LEAD

is a pyramid of ore built of specimens ranging from a few pounds to several tons. From Greenfield quarries comes a handsome marble altar, and from St Louis county, a sample of nickel sulphide, of special interest to mineralogists.

Arkansas, Missouri's geographical neighbor, occupies only a few square feet of space in the extreme southwestern corner of the hall, among the exhibits of Latin-American republics. There the state is represented by a small collection of minerals, consisting mainly of carbonates of zinc.

Upon the frieze of South Dakota's tasteful pavilion is the inscription: "First in gold mining machinery, first in new mines, and second in gold." In support of this claim are exhibited some remarkable specimens of gold ore, though perhaps more noteworthy is the

collection of tin ores from Harney peak. Coal is but feebly represented; for the extensive deposits of South Dakota have as yet been little utilized. In the rear of this section are two life-size figures carved in sandstone, one of a pioneer prospector, and the other of a prosperous, well-dressed citizen of the present day. Among the attractions are also petrified woods from the neighborhood of Sioux Falls, and a tower of Portland cement from a Yankton manufacturer.

The Kansas section in the north of the hall corresponds to that of Iowa in the south, but is of smaller extent. Briefly, lead and zinc ores, metallic lead and zinc, rock salt and gypsum comprise the exhibit, among which are several fine specimens of galena lead, displayed at the entrance-way. Among the collective exhibits in the east gallery are also samples of Kansas cement, and of golden ochre from the Saline river.

The most striking feature in the section allotted to West Virginia is the exhibits of coal, specimens of which are seen at every hand and in all sizes and shapes. This is as it should be, since, both in actual production and in deposits still undeveloped, the state occupies a foremost rank. As is also evident from this display one of the most prominent industries is the manufacture of coke, while petroleum, both crude and refined, calls attention to another source of wealth. Building stones, fire clays, hydraulic limestone, and glass sand are here on exposition, with a refuse substance from a glass factory known as mineral wool which, in appearance and fire-proof qualities, is little inferior to asbestos. In the picturesque mountains of West Virginia are numerous mineral springs whose waters possess valuable medicinal properties, and of these there are a few samples among the more substantial collections.

With the exception of West Virginia, the exhibits of the southern states are installed in the northeastern section of the hall, adjoining the department of machinery. North Carolina has the most elaborate display, and along one side of it are groups of limestone, white, blue, gray, and mottled marble, gray and pink granite, and gray and brown sandstone. In cases arranged along the section walls are many specimens of gold, both free and in the ore, with smaller collections of iron, tin, copper, silver, and coal. Sapphires, garnets, emeralds, smoky quartz, and other gems and crystals are shown, together with such useful products as kaolin, fire-clay, graphite, and talc, the last especially valuable in the manufacture of pencils. In crystalline and silicious forms are numerous



COAL FROM WEST VIRGINIA

samples of corundum, which serves as the basis of many preparations used by dentists and opticians, and also by workers in metal, for grinding, abrading, and polishing their goods. The mica deposits of North Carolina furnish an interesting collection, and the exhibit is diversified by a number of large photographs displaying various localities which nature has enriched with mineral deposits.

In Virginia's section, one of the most attractive features is the picturesque scenery along the line of the Chesapeake and Ohio railway, depicted in the background. Among the exhibits proper the most remarkable are two large masses of iron ore and coal, the former of which is the nearest approach to steel that nature has made, while the latter is a coking and almost smokeless variety, and combines more desirable qualities than



any that have yet been mined. In the North Carolina collection are specimens of zinc, lead, and tin ores, the ores from which mineral paint is made, and granite, slate, and other building and ornamental stones.

Between the New Jersey and Minnesota pavilions a small section is jointly occupied by Louisiana and Tennessee. The latter presents a few specimens of iron, coal, building stones, and the clays used in the manufacture of bricks and tilings. Louisiana occupies the greater part of the space, and of special interest are the exhibits of chalk kaolin, and the clays used by the potter and the maker of imitation meerschaum pipes. There are also a few samples of iron, gold, and silver ores, of sandstones and whetstones, and of soda and potash; but the most striking exhibits are of fine, coarse, and rock salt, one of them representing a figure of Lot's wife standing in the foreground.

Except for a shaft of semi-bituminous coal at one of the western approaches to the Mining hall, and erected by a manufacturer of mining machinery, Maryland is without representation in this department. South Carolina and Florida find expression in the eastern galleries, especially in their lavish display of phosphates, the one from the Palmetto state being mainly contributed by mining and manufacturing companies of Charleston. Among them is crude phosphate rock, mined both from the river beds and the dry soil, together with strange forms of fossil life. From Florida are also samples of phosphates, both in its crude state and prepared as a fertilizer, the exhibit being arranged in a frame of native woods which shows the geographical outlines of the state.

Before describing the exhibits of the Pacific slope, whence comes our main supply of the precious metals, a few remarks may be of interest as to the relative yield of gold and silver, and the conditions evolved thereby. Of the total output of the United States, amounting for the century ending with 1892, to nearly \$2,000,000,000 in gold and \$1,200,000,000 in silver, less than one per cent was produced between 1792 and 1847. Then came the discovery of Marshall, who was about to throw away as iron pyrites a handful of what proved to be scales and nuggets of gold, picked up near the historic saw-mill in Coloma valley. In the single year of 1849 more gold was taken from the earth than during the half century which preceded it, production gradually increasing until in 1853 it reached its maximum value of \$65,000,000, gradually diminishing to less than \$40,000,000 in 1862.

Meanwhile the Comstock lode had revealed its treasures, and from an average of less than 40,000 ounces for many previous years, the total output of silver rose to 6,600,000 ounces in 1863, gaining in volume, though with many fluctuations, until for 1892 it was estimated at 58,000,000 ounces, for the waning yield of Nevada mines had been more than compensated by the product of Colorado, Arizona, Montana, Idaho, Wyoming, and other Pacific slope states. This was attended with a corresponding shrinkage in value, the price of silver in New York and London falling from \$1.14 to 87 cents an ounce, or a decline of some 24 per cent for the decade ending with 1892, and with a still further depreciation in the following year. Between 1849 and 1860 the production of gold in relation to silver was in the ratio of more than fifty to one in actual weight. Thenceforth these conditions were gradually changed until, for the ten years ending with 1892, there were produced about twenty-five ounces of silver to one of gold, while for the last of these years the proportion was thirty-six to one. Here is the key-note to the silver question; for the precious metals are merely commodities, and like all other commodities, are subject to the inexorable laws of supply and demand. To place a fictitious value on silver is no more practicable than to place a fictitious value on coal or iron, on wheat or pork, and all such efforts

can only result in making the United States the dumping ground for the loose silver of the world. Such, at least, are the teachings of political economy, a science the merest elements of which it would seem that many of our law-makers have yet to learn.

Though with a vastly diminished yield as compared with earlier years, California still occupies the foremost rank as a gold-producing state, her output averaging from \$12,000,000 to \$13,000,000, or more than one-third of the present production of the United States, while of the total yield, since 1848, more than two-thirds must be accredited to the golden state. Of silver her annual product is less than \$1,000,000, and has never exceeded that amount. Of quicksilver a considerable amount is pro-



GOLD, SILVER, COPPER AND LEAD



WITHIN IDAHO'S PAVILION

duced, the New Almaden mine alone contributing since 1850 more than 70,000,000 pounds. Iron is widely distributed; but can be imported at rates that almost prohibit local development. It was not until 1880 that the first smelting works in California were erected at Clipper gap in Placer county, with a capacity of 15,000



SPECIMENS OF GOLD AND SILVER ORE, IDAHO EXHIBIT

Pacific slope, these resources, apart from the precious metals, are as yet but little appreciated.

To the Pacific states a liberal space was allotted in the southeastern section of the hall of Mines and Mining, flanked on one side by exhibits of mining machinery, and separated by the central nave from those of foreign lands. In front of the group is the pavilion of the golden state, in which are displayed to excellent advantage her many varieties of building materials. The portal is constructed of various kinds of stone, in the form of a triple arch, thirty-six feet in length, with wings on either side, with base of dark granite and white marble columns from Colton and Inyo quarries. The caps of the columns are richly carved, supporting a handsome entablature, and behind them are pilasters of onyx, beautifully veined. The arches are of grey sandstone, the panels and pediments of variegated marble, and the wings of blue green-stone, nearly all the best of California's building stones, some of them highly polished, being represented in this pavilion.

The specimens gathered during a series of years by the state mining bureau form the basis of the exhibit, and to these were added contributions from private collections, forming together a valuable assortment of economic minerals, some of them almost a novelty to the scientific world. In double rows of show-cases are choice samples of gold and silver ores, containing some \$20,000 worth of metal, and representing all the more prominent mines. Here also is the metal itself in various forms; but the centre of interest in the California section was the historical nugget which Marshall picked up from the Coloma mill-race on a January morning in 1848, the finding of which revolutionized the commercial conditions of the world. This, however, was a treasure presumably of too great value to be trusted by its owner, even under the care of the Exposition authorities, and was removed not long after the opening of the Fair.

Upon the walls and around them are souvenirs and memorials of pioneer days, including a portrait

tons a year. Coal, though abundant, is for the most part in narrow seams, of inferior quality, and in localities difficult of access, the only productive veins of importance being near Mount Diablo, within a few miles of San Francisco bay. Of petroleum 8,000,000 gallons were obtained in 1884, and since that date a much larger quantity. The largest works are in Ventura county, whence the crude oil is conveyed in iron pipes to a shipping point on the coast. Asphaltum, formed by the evaporation of the volatile portion of the oil, is also plentiful in several of the southern counties.

Of copper there is enough to supply the demands of the world, but with less than \$100,000 worth annually taken from its native gangue. Borax is largely produced in San Bernardino and Inyo counties, from a tract 10,000 acres in extent. In Lake county there are also valuable deposits, together with a sulphur bank, on the eastern shore of Clear lake, where sulphur was first manufactured in 1861. The first bar of tin, fashioned in the United States from native ore, came from a California mine; but, as an industry, tin mining has thus far proved unprofitable. Mineral soap, for which no better name has yet been adopted, was known to exist as early as 1849, and mineral paint has become an article of commerce. Building stone is abundant, a marble quarry in Tuolumne county being worked in 1857, while, near Auburn, in Placer county, is granite of excellent quality. Of mineral springs there are fifty which serve as health resorts, with twice as many more unknown to fame. Among metals and minerals but little utilized may be mentioned saltpetre, asbestos, antimony, platinum, chromium, mica, bismuth, zinc, and iridium. Such are the principal resources of California as a mining region, here mentioned not with intent to give special prominence to that state, but because, as elsewhere on the



SILVER AND LEAD FROM UTAH

of Marshall, photographs of hydraulic mining and mining processes and districts, among them Sutter's mill and mine, with the primitive rocker and pan, the mining methods of those days being a cross between Mexican tradition and Yankee ingenuity. In models is illustrated the science of mine timbering, especially as applied on the Comstock lode, in Nevada, in what is known as the crib system of timbering, invented by a German miner and scientist, Philip Deidesheimer by name. When a depth of some 200 feet was reached in the Ophir mine, the ore body was found to be 45 feet in width, thus rendering almost useless the post and cap system before in use, for such would not uphold the roof of the chamber. Then it was that this man came to the rescue, framing timbers in square sets or cribs from four to six in size, piled one upon another, and filled with waste rock, thus sustaining lateral as well as downward pressure. The plan was widely adopted; and but for this or some similar appliance, the deeper workings of the Comstock, which have added nearly \$350,000,000 to the stock of precious metals, would never have reached, as later they did, a depth of more than 3,000 feet. In statistical and other forms much valuable information is conveyed, and here not a few among the pilgrims of



the Fair will learn for the first time that of the total yield of gold, amounting since 1848 to \$1,900,000,000 for all the United States, California has contributed \$1,310,000,000.

Oregon's display, though unpretentious, was somewhat of a surprise to the majority of exposition sight-seers. Coal, iron, and copper were known to exist in abundance; but few were prepared to see in this collection such specimens of gold and silver ores as are here exhibited. Among them are samples of gold quartz assaying several hundred dollars to the ton, one of them from the surface croppings of a recently discovered mine. Nearly all the mineral products of the state are represented, and in a model is shown the process of hydraulic mining. In 1891 Oregon produced more than \$1,600,000 worth of gold, and some \$300,000 in silver, the former the largest yield recorded up to that date, the principal mines being in the southwestern districts where the veins are small but rich. Since, in 1855, the first cargo of coal was shipped to San Francisco from the Coos bay mines, these beds have been worked without intermission, the maximum yield of 82,000 tons being reached in 1887, while the gradual decrease to 35,000 tons in 1892 was due only to low prices and labor troubles; for the deposits are practically inexhaustible. In few sections of the United States are iron ores more widely distributed or more advantageously located, the Oswego works furnishing this metal to Oregon and California foundries for more than a score of years. Copper ores are plentiful and rich, though as yet but little utilized.

Of nickel there is in Douglas county one of the largest mines in the world, rivalling the famous deposit in the Sudbury district, in the Canadian province of Ontario. Platinum and iridium are found in connection with placer gold; cinnabar exists in several districts, and with marble, granite, and other building stones, few of the Pacific states are better supplied.

In Washington's tasteful pavilion of terra cotta are 150 tons of mineral samples, gathered from every mine at which samples could be obtained. Among them are gold, silver, iron, lead, and copper ores; with coal, granite, marble, and onyx; sands and clays; bricks,

tiles, and terra cotta; thus representing the principal mining resources and industries of this young and ambitious commonwealth. Here also, or in the state pavilion, are reproduced in models or in graphic art several of the more prominent mines, with the mountains and ravines in which they were discovered, with assays, statistics, and other information conveyed in attractive form. In the centre is a monument composed of gold, silver, lead, and copper ores, the shaft entirely of silver specimens, and around it groups of minerals in various designs. Near by is an ornate structure of similar materials, with a large mass of magnetic ore. The entire display is a credit to the evergreen state, which, to add to its attractions, purchased a number of gold nuggets, and even constructed roads to remote districts where contributions had been promised.

In comparison with other metals and minerals, Washington's yield of gold and silver is inconsiderable, the latter amounting for 1891 to less than \$600,000. During the régime of the Hudson's Bay company coal was discovered in the Cowlitz valley. In 1852 deposits were found on Bellingham bay, and between 1860 and 1879 produced at the rate of 13,000 tons a year. Meanwhile more valuable beds had been disclosed, and the total output gradually increased to its maximum of 1,264,000 tons in 1890, the yield for 1892 being estimated

at 900,000 tons. The entire area of coal lands has been stated at 180,000 acres, most of it within 40 miles of tide water, a single company owning claims on the Squak river two miles in length, with veins occurring at intervals from five to twelve feet in thickness, and said to contain 10,000,000 tons of merchantable coal. Bog-iron ore is abundant, and in Iron mountain, near the Snoqualmie pass, are veins of magnetite from 50 to 150 feet in thickness. On Kettle river are copper ores assaying from 50 to 75 per cent, all these and other resources as yet almost untouched.

Turning to the adjacent state of Idaho, we find that her yield of the precious



COLORADO'S PAVILION

metals was estimated for 1892 at 90,000 ounces of gold and 3,250,000 of silver, the latter the smallest output in several years, due to extreme depression in prices, and to labor troubles in Cœur d'Alène, the principal argentiferous district. From the low-grade galena ores of this district, occurring in veins of considerable width, and with no indications of failure as depth is attained, were extracted in 1891 nearly 2,000,000 ounces of silver, and



COLORADO EXHIBIT



NEW MEXICAN MODELS

copper ores of the Bear lake district assay as high as 75 per cent. of sulphur, much of it containing 70 to 80 per cent of mineral, and at the Oncida salt works a marketable quality of salt is produced by simply boiling the water of springs in galvanized iron vessels. In northern Idaho there are mica, marble, granite, and sandstone, and almost throughout the entire country metals and minerals of economic value are widely distributed.

First among the hundreds of exhibits contained in Idaho's classic pavilion, colored in white and gold, may be mentioned that of the state, including, among others, samples of gold, silver, and

copper ores, cinnabar, building stones and clays, quartz crystals, sapphires, amethysts, and ruby sands. From nearly all the more prominent mines contributions were secured, each county being thoroughly canvassed, and with the result that nearly 2,000 samples were forwarded to Jackson park in several car-loads. Not a few of these are contained in the 2,500 cabinet specimens, selected by an expert, who also states the name of the mine and its owner, the assay value of the ores, the depth at which they were obtained, and other information of interest to mining men.

Gold and silver are freely displayed in the Idaho section; the former in the shape of nuggets from private cabinets, some of them found in the placers worked in pioneer days. Of wire silver there are beautiful specimens, delicate threads of pure silver, resembling filigree work, clinging tenaciously to bunches of galena ore. Among the exhibits are two rectangular blocks of what appears to be lead bullion, but is in fact galena ore, containing 75 per cent of lead, 15 of sulphur, and 130 ounces of silver to the ton. Of palladium ore there are samples from the Esmerelda mine in Lemhi county, where it is found in bunches yielding two or three ounces to the ton, in combination with free milling gold. This rare and valuable metal possesses the hardness of the finest steel, and is used, among other purposes, for astronomical, surveying, and electrical instruments, the main



MONTANA'S SILVER STATUE OF JUSTICE



66,000,000 pounds of lead, Idaho ranking next to Colorado in production of the latter. Says one who has made a careful study of her mines: "Cœur d'Alène is most favorably situated for producing lead, the silver being almost a by-product. The ore is cheaply worked, and numerous streams afford ample water power. These mines can be operated at a profit with the price of white metal so low that others are compelled to shut down."

Apart from the precious metals, Idaho has an abundance of coal, iron, copper, sulphur, and salt. From the Narragansett mine in Owyhee county iron ores have been taken so rich in metal as to be cast into dies for stamp-mills, and elsewhere are veins which yield from 50 to 60 per cent, while the Near Soda springs is an immense deposit



MANUFACTURES AND GOVERNMENT BUILDINGS FROM THE LAGOON

supply coming from South American countries.

Of pure aluminium there are samples extracted from the clay banks of Kootenai county, said to contain more than forty per cent of the metal. Among valuable stones are the onyx and opal, the latter found in a recently discovered mine on the banks of Snake river, and taken from matrices several inches in width. From Lewiston comes a specimen of rock almost unknown to scientists, of variegated tints somewhat resembling jasper, and one that will cut glass more readily than a diamond. Iron and copper ores are in liberal supply, and a large case is filled with samples of lead and copper concentrates; of granite, marble, and alabaster there are several exhibitors, and of asbestos



MONUMENT OF GERMANIA IN PORTLAND CEMENT



MONUMENT OF PORTLAND CEMENT

there is a sample from Owyhee county, where a deposit was found in the autumn of 1892. Finally there is a large collection of mineral waters, in which, as in other resources, Idaho is especially rich, awaiting only the means of transportation for their fuller development.

Except for Alaska, whose yield of gold already exceeds \$2,000,000 a year, and with one of the largest gold quartz mines in the United States—the Treadwell lode on Douglas island—with immense deposits of low grade but dividend paying ore, Nevada is the only section of the Pacific slope that is not represented among the main exhibits of the Mining department. And yet, not many years ago, Nevada was the largest silver producing region in the world, the bullion product of the Comstock mines alone amounting to \$350,000,000, and for the single year of 1876, when the maximum was reached, to more than \$70,000,000.

Utah has some 300 exhibits of gold, silver, silver-lead, copper, zinc, iron, and other ores, with building stones, coal, antimony, quick-silver, sulphur, salt, asbestos, and other metals and minerals, all neatly arranged and fairly representing the abundant mineral resources of the territory. In iron Utah is especially rich, with surface deposits in Iron county alone estimated at 50,000,000 tons, one of them a solid mass of magnetic ore, 1,000 feet long and half that width, from which analyses show from 60 to 65 per cent of metal.

Of the 163,000 tons of copper obtained from domestic ores in 1892, more than one-half came from Montana, whose yield for that year was 82,150 tons, against 53,700 tons for Michigan mines. Of this enormous output, the largest thus far on record for a single state,

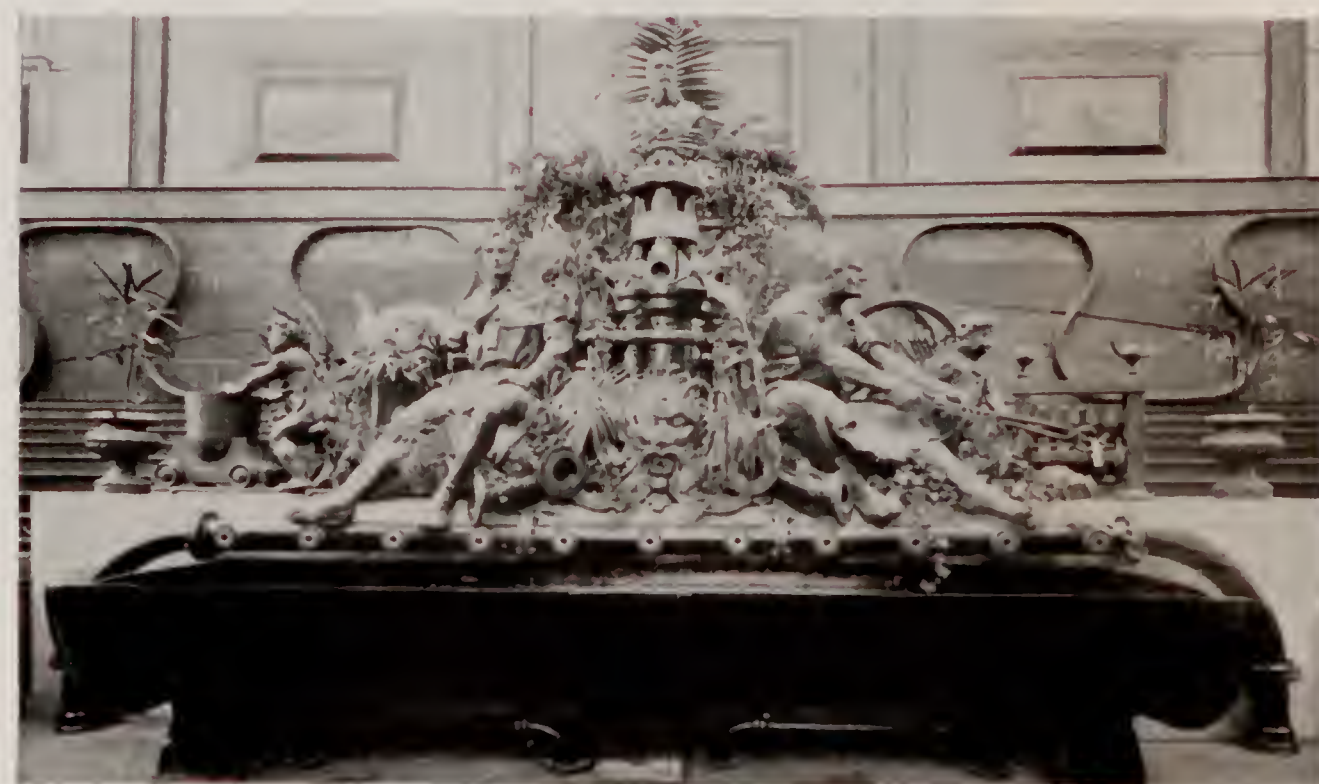
50,000 tons came from the Anaconda company's works, whose property includes, besides the mine of that name, the St Lawrence and the so-called Chambers Syndicate mines. Of the precious metals Montana is also one of the largest producers, her yield of silver exceeded only by that of Colorado. Of gold, silver, lead, and copper her total output for the decade ending with 1890 was estimated at \$250,000,000, of which more than two-thirds consisted of gold and silver. In that year was claimed for this state the largest gold mine, the largest silver mine, and the largest copper mine in the country, and in the following year the volume and value of mining products were the largest yet recorded.

Of the several hundreds of exhibits displayed in the Montana section, more than sixty consist of copper and silver-copper ores, both metal and mineral being displayed in every phase of production from sulphides



MEXICAN ONYX

and matte to sheet, tube, wire, and other manufactured forms. Of silver, gold, and silver-lead ores thousands of specimens are exhibited by more than 400 contributors. There is also the largest collection of nuggets contained in the Mining hall, one of them weighing nearly 48 ounces, and with 96 per cent of pure gold. Near it is a display of gold crystals, sapphires, and garnets from El Dorado bar on the Missouri, and within a few miles of Helena, and in another case are trays of gold-dust from the placers, each one holding about \$1,800 worth of metal. Of coal there are many samples, and the building and other stones and minerals of economic value include granite, marble, porphyry, limestone, clays, gypsum, sulphur, graphite, and asbestos.



FOREGROUND OF THE STUMM EXHIBIT

which stands a case of specimens from the Elkhorn district, is the statue of Justice, fashioned of native silver, and with orthodox scales and sword. In this statue, placed under a canopy of maroon velvet, in the centre of the pavilion, and guarded by two bronze lions, was used nearly a ton of sterling silver, the figure resting on a silver globe, beneath which is an eagle with outstretched wings. The lower portion of the pedestal is of ebony, and upon this is a plinth of pure gold, more than two feet square, and representing, as is said, a value of \$250,000. The model selected for this, the largest silver statue in the world, was the actress Ada Rehan, whose stately and opulent form is cast in heroic mold. Behind the statue is a structure fashioned of copper bars; on the walls the more prominent mining centres are reproduced in photographs, and at the back a painting, named *A Good Strike*, represents the scene which its title indicates.

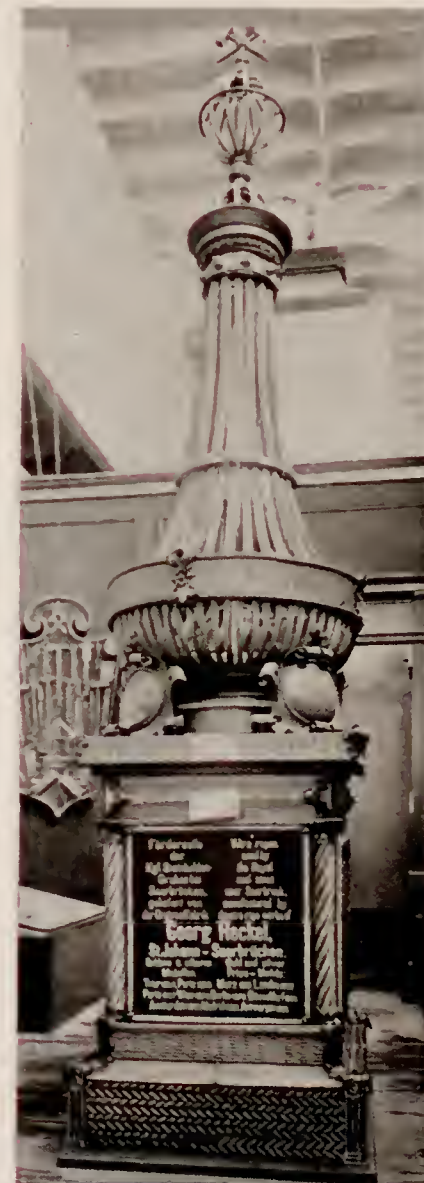
Colorado is well represented, as befits a state which in 1892 produced \$5,500,000 in gold and more than \$30,000,000 in silver, taking the lead of all other sections in her output of the precious metals. Of coal the production increased from 4,500 tons in 1870 to 3,800,000 tons in 1892; of iron the yield for the latter year was 32,000 tons; of lead, 61,000, and of copper 3,600 tons. Add to this her wealth of building and other valuable stones, her carnelian, chalcedony, onyx, jasper, jet, and agate; her petroleum deposits, almost rivalling those of Pennsylvania, and already producing at the rate of several millions of gallons a year, and it will be seen that Colorado is not wanting in mineral resources.

The section allotted the centennial state, adjacent to the southern portal of the building, is faced along the aisles with marble, and on either side of the main entrance are polished granite pillars with capitals of red sandstone. Within is a circle of columns fashioned of various building stones, and a pillar of granite surmounted by a globe, and a massive coal trophy, eight feet square at the base and twenty-four in height, dominate the entire display. Two sides of the structure are lined with cases filled with specimens of ore, and masses of gold and silver bearing quartz are grouped along the aisles, while in the centre, wire, nugget, placer, and other forms of gold from the Breckenridge district are freely displayed, together with gold and silver roses from a Denver exhibitor.

Among the many thousands of cabinet specimens contained in this collection, including those in the gallery, a large proportion was furnished by the state school of mines at Golden, and from the Colorado scientific society are samples of eruptive rocks and meteorite, forming together a most valuable and comprehensive assortment. From the more prominent mines there are also contributions, and from business, manufacturing, and other firms and companies are exhibits of coal, coke, iron, marble, building stone, slate, clay, asphaltum, petroleum, mineral waters, and other products, together with smelting and refining processes. Above the cabinets are photographs of the principal mining regions, and of buildings fashioned of Colorado stone, while in map form are depicted the geological and topographical features of the state.

The state has a large and valuable collection, among which are silver, silver-lead and iron ores, and surface copper; marble and other building stones; yellow and red ochre, manganese, malachite, chrysolite, tourmaline, dendrites, stalactites, rhyolite, rose and agatized quartz, garnets, jasper, and chalcedony. In a tin brick weighing some thirteen pounds, made by the students of the college of Montana, is represented the yield of that metal for 1892. Another curiosity is an old wooden cam which did service in 1864 at a four-stamp mill on Grasshopper creek, in the Bannack district, where two years before were discovered its placers and quartz ledges.

But the centre of attraction in Montana's beautiful pavilion, at the entrance of



GERMAN WIRE CABLE

From Aspen come samples of silver ore that average from 70 to as much as 20,000 ounces to the ton, the latter rather an exhibit of metal than of metal bearing rock. From Leadville are also some high grade specimens from the Chrysolite mine, especially of bromo-chlorides; Forest city sends carbonates that assay 2,500 ounces, and the Lion mine carbonate ores almost as valuable. Of auriferous ores there is also a large collection, including ore from the Elkton mine containing more than \$7,000 to the ton in free gold; from the Blue Bird mine telluride which yields up to \$1,200 a ton, and others whose average varies from \$7 or \$8 to \$1,100. Of turquoise there are beautiful specimens from the Blue Gem mine at Villa Grove, and in a word nearly all the minerals of economic value contained in the centennial state are here on exposition.

Arizona's exhibits, adjoining the Colorado section, are displayed to excellent advantage on a raised platform, in the centre of which is a monument of copper ore, in rich colors of blue and green, one of the



specimens of which it is composed weighing nearly 7,000 pounds, and the smallest exceeding 800 pounds. Around it are cases of cuprite, azurite, malachite, and other minerals of brilliant hue, some of the samples from the Holbrook mine, where is a cave of stalactite, being covered with incrustations of silver. In blocks of ore assaying from 30 to 70 per cent are represented all the more prominent copper mines of Arizona, whose total yield for 1892 was estimated at 19,000 tons. The metal itself is shown in the form of bricks, bars, sheets, rolls, plates, wires, and all other forms in which it is manufactured, and from one of the exhibiting companies are models of its mines and apparatus.

Of gold and silver ores and ores of silver and lead there are nearly 100 exhibitors, one piece of gold ore assaying a dollar to the pound; and from Cochise county, which furnishes the bulk of the collection, are a few gold nuggets, and a sample of onyx nearly eight feet long by two in width; while Mohave county, which is also well represented, presents specimens of agate and silver glance or sulphurets. Sandstone of finest grain is shown in the form of slabs and pillars, and there are portions of petrified trees, some of them beautifully polished.

Almost in the centre of New Mexico's section is a structure composed entirely of native ores in the form of a miner's cabin, and near it are relief models of several prominent mines. Beyond are pictures of the typical miner in orthodox costume, and with his patient and long-suffering burro. Here and in the western galleries is a large collection of minerals, including all the varieties discovered since, in 1832, were extracted from the so-called old placers a few thousand dollars worth of gold. Nearly all the metals common to the Pacific slope are contained in these sections, the greater number of the exhibits consisting of gold, silver, silver-lead, and copper ores; while coal is represented in the form of a pyramid, its materials furnished by the Madrid mines, the property of a railway company.

Coal is the feature in Wyoming's exhibit, representing an industry whose output for 1892 was 94,000 tons. Iron and copper are widely distributed; but neither have been as yet extensively worked, though in Albany county is a mountain of ferruginous rock assaying as high as 80 per cent of metal. Petroleum is found near the surface in many localities; near Laramie is a large deposit of mica; building stone is abundant; agates, amethysts, and other valuable stones have been found in the valley of the Sweetwater river; plumbago and graphite, soda, sulphur, asphaltum, and asbestos are among Wyoming's minerals, and the precious metals are found in many portions of the state. All these are represented in her pavilion, in which the central point of interest is a shaft of coal from the Black hills mines, most of the material furnished by the Union Pacific Coal company's works at Rock springs. The Wyoming Railway and Iron company has a large collection of ores; asphaltum is freely displayed, and in glass tubes are the various grades of petroleum manufactured by the Black Hills Oil company.

In addition to those already mentioned, California, New Mexico, Nevada, and Colorado have exhibits in the northwestern galleries, consisting principally of cabinet specimens, covering the entire field of their



ENTRANCE TO ONTARIO EXHIBIT

mineral wealth. Nevada, to which no space was allotted on the ground floor, occupies the largest area, the White Pine district making an elaborate display. In quartz crystals and ornamental stones the collection is especially rich. The Gunnison region of Colorado sends many specimens; but the feature in this section is the heroic figure of the Silver Queen of the World, seated in a triumphal car of silver, the canopy overhead and the foundation upon which it rests being richly encrusted with powdered crystals. This foundation serves as the entablature of several marble pillars, those at the main entrance being arranged in pairs. Cupids precede the chariot, scattering as they run disks of gold and silver, each piece as it falls from their cornucopias displaying the watchword, Free Coinage. Beneath their feet and upon the front of the structure are skilfully fashioned in mineral substances the words, Aspen, Colorado; and specimens of ores and gems are tastefully displayed.

First among the exhibits of foreign participants may be mentioned Germany's elaborate display, one in which are fully illustrated the mining and metallurgical industries of an empire which ranks first among the continental nations of Europe, her volume and value of production exceeded only by that of England and the United States. Of gold and silver extracted from native ores the yield is inconsiderable; but from imported ores there were produced in 1890 several thousand pounds' weight of gold, and of silver, in connection with the smelting of lead and copper, more than 400 tons. Of coal the German output for 1892 was 71,000,000



CANADIAN NICKEL ORE

with fire-breathing dragons at his feet. Within is a large metal basin, on which are the brawny figures of workers in iron, assisted by sturdy lads, one of whom is helping to grasp with his tongs a bar just issuing from the roller, while the other is pushing a cart filled with molten ore. Above this group is a bust of Baron Stumm, the founder of the works from which it came, the Vereinigte Eisenwerke of Neunkirchen, one of the largest of Prussian foundries, employing several thousand hands, and producing an enormous quantity of manu-

factured iron. Among its exhibits, which form one of the most imposing collections in the hall of Mining, is a portico of cast iron pipes, flanked by obelisks of rolled and forged iron, the metal being displayed in many structural forms, including coils of wire towering like some huge tropical plant, almost to the roof of the building. In the background is a terrace of rails, and above it a cold-bent specimen, stretching in serpentine form along the rear walls. Here also is reproduced the iron superstructure of the Gott-hard railway station, and near by are models of the mills and the dwellings occupied by mechanics.

Near the southern portal of the hall, not far from the Colorado section, is an imposing structure composed of seamless steel tubes, erected by the Mannesmann works of Berlin. The exhibit consists of tubing for boilers and pipe lines, whether for oil, gas, water, or steam, and hollow tapered poles for telephone, telegraph, electric light, and electric railway purposes. The special feature in these articles is that all are rolled from solid blocks by a patented spiral process, which causes the fibres to twist

into a rope-like and extremely tough material.

Elsewhere in Germany's section are specimens from her quarries and coal mines, with coal tar, oils, and paraffine, graphite and its products, and ornamental specimens of zinc. A Heidelberg firm has erected an elaborate structure composed of cement and gravel, though seemingly fashioned of limestone of a bluish tint. At the entrance is an archway with female figures in classic pose. Of cements there are several exhibits, and in the display of a Berlin laboratory are machines and apparatus for comparative tests of this compound, especially of the Portland variety, the experiments conducted in accordance with regulations framed by the government. By the Lehrte and Mis-burg firm of Manske and company was erected, near the live-stock pavilion, a portal of artificial sandstone, on which is a heroic statue of Germania, its flooring and stairway made of slabs of cement, and with piles of casks containing the manufactured article.

In the gallery the German division is in compartments, in one of which is a tall gilded shaft, its face

tons; of pig iron, 4,900,000 tons; of sulphur and sulphuric acid, 437,000; of zinc, 140,000; of lead, 98,000, and of copper, 25,000 tons; these representing the principal economic minerals whose product was valued for that year at about \$225,000,000. Copper is largely imported, the only important deposit being a vein of cupriferous schist in the Mansfield mines, of inferior quality, but largely utilized through elaborate mining processes; for the Germans have no superiors as metallurgists, the inception of this science dating far back to the prehistoric era of the fatherland, and in the middle ages attaining a higher development than elsewhere in the world.

The German exhibits are divided between the ground and gallery floors, the latter containing chiefly such as pertain to metallurgy and mining processes and apparatus. A considerable portion of the ground floor space is occupied by the Stumm pavilion, at the entrance of which is a massive iron gateway, surmounted by the heroic figure of a blacksmith,



MICA AND LIME



BRITAIN'S TROPHY OF COAL

representing in sections the relative yield of mineral products. Amber is freely displayed, and in many of the specimens are imbedded various forms of insect life. Other attractions are a tower of iron ores, a model of the Royal Prussian salt-works, and a scientific collection of crystals, with models of crystalline forms, showing geometric figures in different minerals and their interior lines of contact. But the feature of the gallery groups is the models of mines, illustrative of processes and apparatus, and especially of coal mines, by which are produced so large a proportion of the mineral wealth of the empire. The last are contained in the general exhibit of Prussian mining, some of them showing the method of wetting the face of the works so as to prevent the spread of fire-damp. Here also is shown a coal dressing plant at the royal mines at Saarbruck, with a drift run in the König colliery to test the use of explosives in the presence of fire-damp.



UNITED STATES SECTION—MEXICAN AND GERMAN EXHIBITS TO THE LEFT

Coal and iron are the principal mining products of the British isles, the value of the former being more than six times that of the latter even in metallic form, while the annual yield of pig and bar iron represents nearly 90 per cent of the total value of all metals produced from native ores. In 1891 there were extracted 185,000,000 tons of coal, worth \$350,000,000, and giving employment directly to 650,000 miners and laborers; of iron ore nearly 13,000,000 tons were worked into \$58,000,000 worth of metal; of lead the output was 32,000 tons; of tin and zinc, each about 9,000, and of copper only 700 tons. The last of these metals is now almost entirely imported, its production steadily decreasing since 1855, in which year the production was 21,000 tons. Meanwhile the steadily increasing yield of the United States, Chile, Australia, and other countries had diminished the price by nearly 60 per cent; this, with the gradual exhaustion of the larger deposits, causing a virtual cessation of copper mining in Great Britain. Of iron the production also shows a decrease of about 20 per cent within the last fifteen years, and with a more serious decline in value. Of non-metallic minerals apart from coal, and consisting mainly of building and other stones, clays, gypsum, salt, and oil shale, the yield may be estimated at \$70,000,000, and the entire mineral yield of Great Britain is not far short of \$450,000,000. Silver, found in combination with lead ores, is produced at the rate of 200,000 or 300,000 ounces a year, and of gold a few hundred ounces have been taken from low grade deposits in Wales, while from a mine in Wicklow county, Ireland, have come a few ounces, costing perhaps fifty times their value to extract.



PRINCIPAL ENTRANCE TO SECTION OF NEW SOUTH WALES

First among the British exhibits may be mentioned the large collections of minerals, somewhat too widely scattered around the pavilion, but representing together all the minerals of economic value found in the United Kingdom. Among them are many specimens of interest to the scientist, as of the blue-ball clays used for a century or more in the manufacture of the finest descriptions of earthenware; flint and flint implements such as Britain has produced from time immemorial, jet from jet shale in Yorkshire beds, and auriferous quartz with its encasing rock from North Wales. The processes of smelting lead and copper ores are shown in samples from metallurgical works, the former both by reverberatory and blast furnace methods, and the metallurgy of nickel is displayed in samples from a Birmingham establishment, while Sheffield and Bradford firms show how steel and iron are wrought into various forms.

Among the blocks of coal is one second only to the Washington specimen, contained in her state pavilion and presently to be described, the former weighing more than 28,000 pounds and containing 350 cubic feet. Of building and ornamental stones there are slate and granite, the latter in many shapes, as polished columns, monuments, crosses, and concrete paving blocks, with porphyry from ancient Egyptian quarries worked by a London firm as concessionaires. Another group consists of Portland and other cements, limestone, and artificial stones. Fire clays and fire bricks are freely exhibited, as also are kaolin and fuller's earth in its crude and manufactured state. Iron, copper, lead, cobalt, antimony, manganese are among the samples in the collections above referred to, and elsewhere are salt in display and decorative forms, and an assortment of grinding, abrading, and polishing substances and apparatus. While in some respects a creditable exhibit, the British section does not worthily represent the great variety and volume of the mineral products of that country.

To much better advantage appears the dominion of Canada, in her ample space to the north of the British division, and extending thence beneath the gallery floor. In this section a large area is devoted to the collections of the Geological and Natural History survey at Ottawa, and of the several provincial governments, including British Columbia and the Northwest territories. In these are included all the economic minerals contained in the dominion, some of them here for the first time placed on exposition. From the Sudbury district in Ontario comes an ingot of pure nickel weighing 4,500 pounds, with ores and mattes sufficient to give color to the superintendent's opinion that nickel will take the place of tin in the manufacture of household utensils. The ores are mainly of the pyrrhotite description, and of these there are samples from other Ontario mines. Of gold and gold bearing rock the



MINERAL MONUMENTS OF AUSTRALIA

province sends many specimens, most of them from her government collection, and of native silver, silver ores, and argentiferous galenas the exhibits are almost as numerous. Of platinum there is a small display, and of antimony a single specimen from a vein where it is found in combination with silver, lead, and sulphur. There is zinc blende from the Thunder Bay district on the northern shore of Lake Superior. Iron in the form of magnetites, hematites, bog-iron, and magnetic iron sand comes from several score of deposits.



IN THE FRENCH SECTION

Copper and copper ores and pyrites are in plentiful supply, the largest mass being of copper-nickel ore, weighing 12,000 pounds, and forming, with other blocks of copper and nickel bearing rock, a trophy display from the Canadian Copper company. There is a profusion of building and ornamental stones, of clays, marls, and kaolin; of graphite, steatite, actinolite, and molybdenite; with salt, gypsum, quicklime, and hydraulic cement. Apatite, or phosphate of lime, is prominent among the group of fertilizing substances. The Imperial Oil company has a large assortment of petroleum and its products. Asbestos is a feature in the Ontario section, as also are the sheets of mica and the delicately tinted variety known as amber mica, of which there is a crystal weighing 400 pounds from the Godfrey mine in Frontenac county, where in the Sydenham district similar crystals have been found six feet in diameter and with a weight of several tons.

In the exhibits of other provinces those of Ontario are in a measure duplicated. Quebec's collection rivals that of the sister province, especially in the display of asbestos, mica, plumbago, phosphates, building stones, and iron ores, the last from the Canada Iron Furnace company of Montreal. Among New Brunswick specimens are red granite, freestone, and other building stones, with gypsum and plaster. In the Nova Scotia department are many samples of gold and gold-bearing ores, some of the latter assaying many thousand dollars to the

ton. In the central court of the Canadian section is displayed in pyramids of gilded blocks the yield of gold in the several provinces since first it was discovered in British Columbia. Here is represented the output of that province, amounting since 1858 to more than \$53,000,000, with a production since 1862 of about \$9,000,000 from the Cambrian rock formations on the eastern coast of Nova Scotia, and smaller amounts from Quebec, Ontario, and the Northwest territories, the last producing only since 1880. In numerous samples Nova Scotia shows her wealth in coal, for here are some of the largest carboniferous deposits in the world, one of the mines running far under the bed of the Atlantic, and with seams of extraordinary richness. British Columbia and the Northwest have also many specimens of bituminous and anthracite coal, and from the latter are samples of coal tar, petroleum, clay, and building stone. Finally there are shown in topographical and geological charts, in sectional maps, in photographs and drawings, the locations of mineral regions, together with the more prominent mines, their workings and processes.

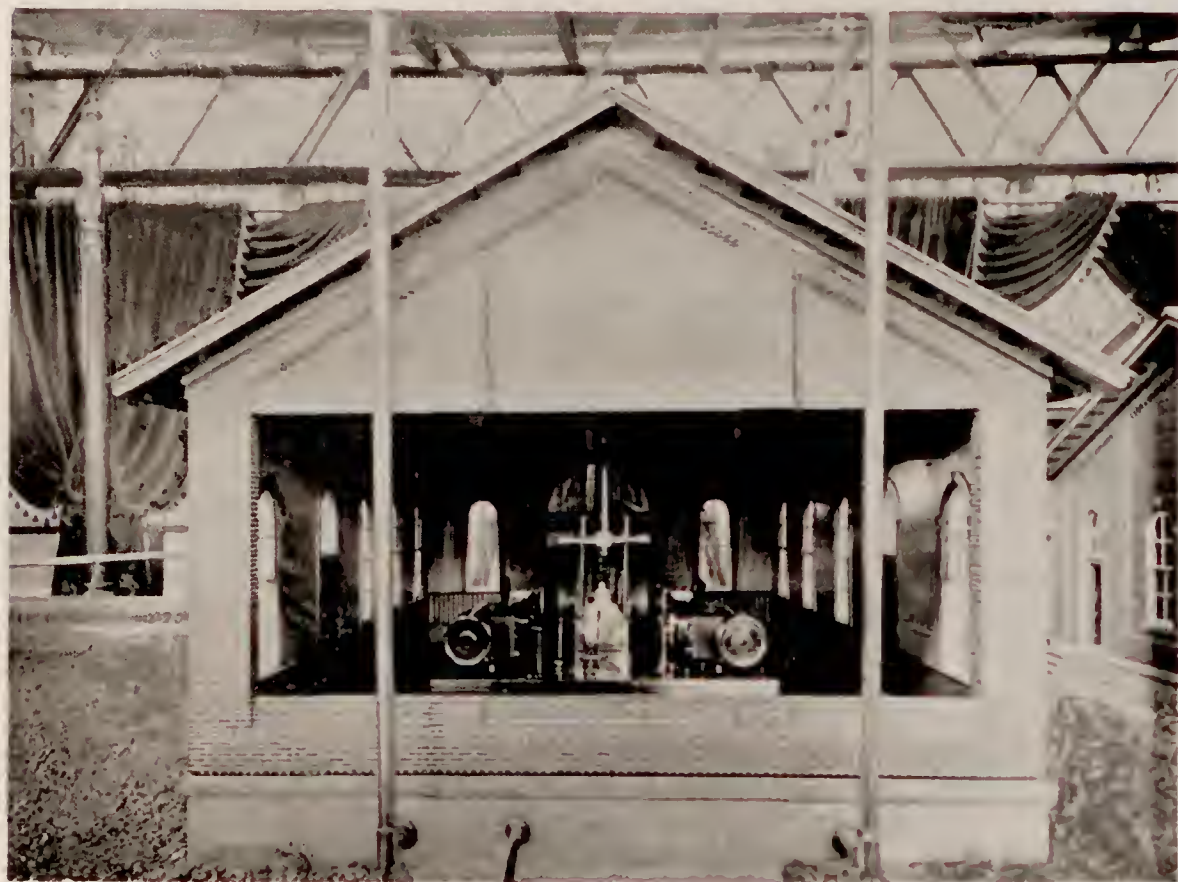
With all her wealth of resources, it is somewhat remarkable that Canada imports more largely than she produces of minerals and their manufactures. First on the list of her products is coal, of which 3,400,000 tons were extracted in 1891, and next in the order named, in relative value, are copper, gold, petroleum, asbestos, iron, and silver. For that year her mining output was estimated at \$20,400,000, against \$25,000,000 of imports, the latter mainly in the form of manufactured iron and steel, which alone amounted to \$14,000,000. Ontario is especially rich in minerals; and here have been recently discovered immense deposits of nickel, especially in the Sudbury district, whence, though the ores are of low grade, yielding on an average less than three per cent, \$2,700,000 worth of that metal were exported in 1891. Of iron, chiefly in the form of magnetites and hematites, and in quality equal to the best of Swedish, there are large and valuable strata. Coal is widely distributed throughout the dominion, the area of coal-bearing lands in the Northwest territories alone being estimated at 65,000 square miles.

From the far north let us turn to the great southern continent, where beneath the



METALS AND METAL WORK

Southern Cross is a land abounding in mineral resources. As in other departments of the Fair, New South Wales is the only Australian colony represented in the mining division, but in this section is fully illustrated the mineral wealth of a country which has thus far produced a larger amount of gold than all the Pacific states. Since, in 1851, a luckless prospector, observing that the California placers were found amid geological formations closely resembling those which he had seen in Australia, and taking ship for that country straightway discovered gold, the southern continent has added more than \$1,600,000,000 to the world's stock of the precious metals. Victoria is the largest producer, her total yield up to the close of 1892 being estimated at



COAL AND COKE

\$1,300,000,000, and of the remainder nearly \$200,000,000 is accredited to New South Wales, whose output gradually diminished from \$56,000,000 for the decade ending with 1860, to less than half that amount for the ten years ending with 1890. The discovery of large silver deposits in the latter colony is of comparatively recent date, and yet from a single district were extracted in 1892 nearly \$12,000,000 of that metal, with more than 40,000 tons of lead.

By visitors of all nationalities it is conceded that the exhibits of New South Wales form one of the most interesting and comprehensive collections in the hall of Mining, far surpassing those of Great Britain and other countries whose appropriations were of much larger amount. In several thousand packages were forwarded hundreds of tons of specimens, consisting largely of gold in every conceivable form, but including also many samples of silver

and silver ores, of coal, iron, copper, lead, antimony, bismuth, and cobalt, with building, ornamental and precious stones, mineral paints, petroleum, cement and lime, and diamond-bearing earth.

At the entrance of the pavilion, fronting on the central nave and north of the Canadian section, is a pillar of frosted silver from the Broken Hills Silver Mining company, whose veins bid fair to rival the far famed lodes of Potosí.¹ The shaft is festooned with garlands and surmounted by a figure of Atlas, supporting his customary burden, with masses of ore at its base, and on one side minor structures of copper, tin, antimony, and silver. From the government collection are silver ores and blocks, and in a nugget of virgin gold is represented \$6,000 worth of that metal, with gold quartz assaying 258 ounces to the ton. To the exhibit of private stones there are contributions from several private collections, and of special value is the display of opals.

In the background of this section are inscribed on a lofty wall statistics as to the mineral yield of New South Wales. Here the visitor may learn that this colony has produced gold to the value of \$187,000,000; silver and lead, \$54,000,000; coal, \$124,000,000; tin, \$46,000,000; copper, \$29,000,000; iron, \$1,800,000; and petroleum and other mineral oils, \$6,000,000. Add to these the value of other products of the mine, and we have a total yield of at least \$500,000,000, for a country whose population in 1892 did not exceed 1,200,000 souls.

Beneath these figures are pillars of various minerals, one of them in the form of a vertical section of kerosene shale. Coal is liberally represented in columns, blocks, and smaller specimens, and in diagram form are shown the thickness of seams and geologic formations of the more prominent districts. Elsewhere are tin, copper, antimony, bismuth, mercury, and iron ores, some of them arranged in structural forms, with ingots and bars of tin and copper, and specimens of the tin-bearing granites of New South Wales, which closely resemble the Cornish formations on the southwestern coast of England, whence tin was extracted long before Boadicea did battle with the Roman legions. Building stones are freely displayed, as also are clays and bricks, and in the form of an entrance way are specimen blocks of colonial marble.

Though as a mining country France does not compare with Great Britain or Germany, her production of metals and minerals is very considerable, the yield for 1892 being valued at more than \$90,000,000. Of coal the output for that year



SPECIMEN OF DOMESTIC ORE

¹Between May 1886 and May 1892 there were taken from the most productive of the Broken Hills mines 36,500,000 ounces of silver and 150,000 tons of lead, some of the ore assaying many thousands of dollars to the ton. Meanwhile more than \$1,300 a

share had been distributed as dividends and bonus on stock on which only \$45 a share was paid up, thus giving a net return of over 3,000 per cent on the invested capital, probably the largest recorded in the history of silver mining.



ALONG THE SOUTHERN SHORES OF THE WOODED ISLAND

was estimated at 26,000,000 tons, and yet with imports of 10,000,000 tons, thus making an average consumption of nearly a ton a year per capita of her population. Of pig iron the annual product is about 2,000,000, and among other metals the largest yield is of zinc, lead, and copper, with a few kilogrammes of gold and a large amount of silver from imported ores.

The French section is adjacent on the north to that of New South Wales; a feature of it is an exhibit from what is claimed to be the only mine in the world which produces pure carbonate of magnesia. Among the more artistic collections are bronzes, enamelled tiles, and casts showing the quality of molding sands.

Cement is largely represented; a Bordeaux mine-owner has a display of manganese, and a few samples of slate, coal, and patent fuels almost complete the list of what France has to show in the Mining hall in the way of native products. In common with Great Britain and some other foreign participants, France is not worthily represented in this department of the Fair, a large portion of her space being covered by a rustic pavilion, with a group of aquatic plants in the centre, affording a place of rest for weary sight-seers. From the Laurium mines in Greece, controlled by Frenchmen, are massive specimens of silver, lead, and zinc, and from New Caledonia a collection of nickel ores, chrome, and cobalt.



MOULDINGS IN SAND. FRANCE



DESIGNS UPON ITALIAN TILES

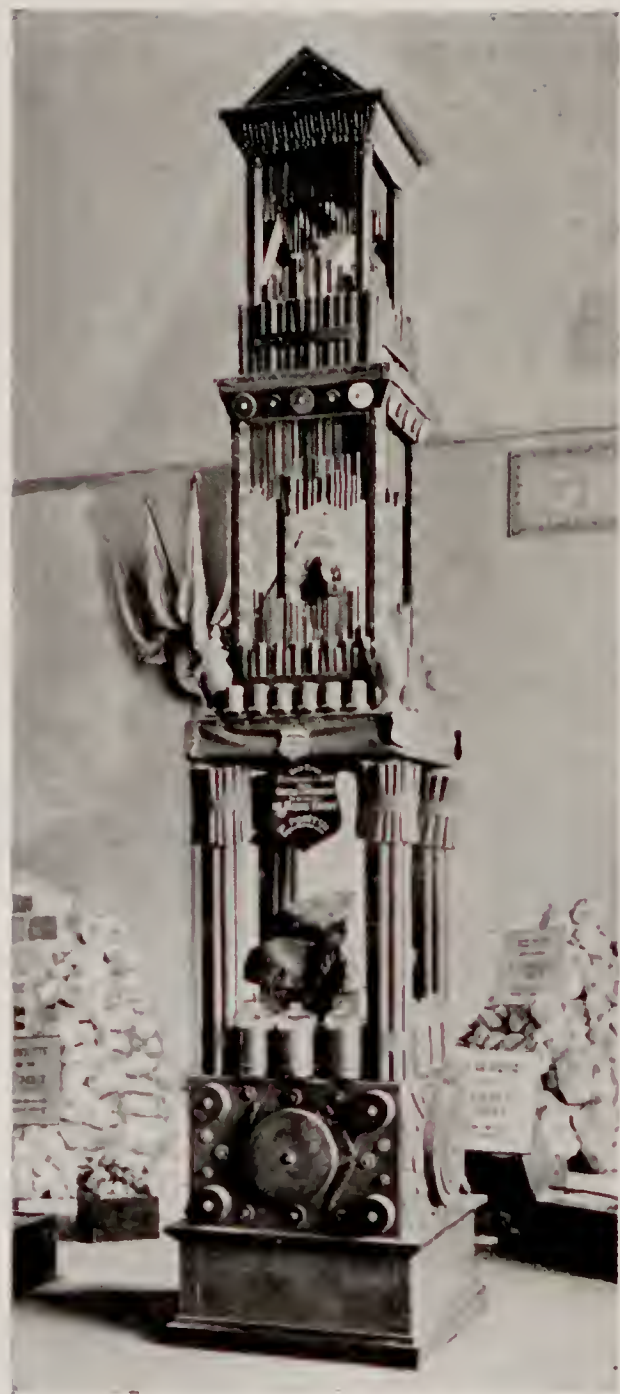
steel, comes from Bohemia, whose metal-workers are almost as famous as those who produce the beautiful glass-ware displayed in the hall of Manufactures.

A feature in the Italian section adjacent to the Canadian groups is a translucent mound of alabaster, composed of blocks as taken from the quarries, side by side with which are beautiful statuettes and other sculptured forms. An admirable piece of work in their vicinity is the leaning tower of Pisa, cut from a block of alabaster extracted near that city. There are also many specimens of the famous marbles of Italy, including a large octagonal font, which for more than three centuries stood in the convent of Gesù e Maria at Rome. This is made of the Claudian variety, one largely used by the Roman Catholic church, as in the cross on the "holy gate" of St Peters, and the consecrated stones of the altar. Sulphur from the Vesuvius and other districts is displayed in blocks and powders, with asphaltum, bitumen, and petroleum, also

In the Austrian section, west of the French pavilion, are several exhibits worthy of note. The mineral waters of Carlsbad are contained in vessels fashioned in the shape of a pavilion, which presents in dioramic form this noted resort, with the lofty mountains that surround it. On the outer walls are depicted in detail the hotels, drinking booths, and architectural features of the place. But it is in iron and steel that Austria makes the best display, noticeable among her exhibits being a hexagonal structure of crucible steel, known as the Poldi variety. The posts, eighteen feet in height, were hammered from ingots, a centre-piece and several cases within representing various commercial forms of the metal, with sections fractured to show the uniformity of the material. Another exhibitor advertises his scythes by cutting sheets of the lightest tissue paper with their keen edges, and on the wall of the aisle is a sheet of iron 160 feet long, a yard in width, and one-twelfth of an inch in thickness, said to be one of the largest plates ever rolled. This, as well as the Poldi



TILES FROM FRANCE



GRECIAN EMERY PAVILION

ture. The iron works of the Ural and other noted districts have also contributed of their ores and first forms of manufacture, and a fine display is made of swords and cutlery, many of the articles with handles of skilful design and workmanship. Maps indicate the most promising and productive districts for gold, coal, petroleum, salt, iron, copper, and other minerals. There are also photographs of the more valuable mines of coal and rock salt, and near one of the entrances are massive specimens of the latter, in contrast with which blocks of black marble display their shining surfaces.



JAPANESE MARBLE

and maps showing the location of coal-fields and collieries, as well as the geological distribution of soils, while specimens of the soils themselves may also be examined, the entire exhibit being mainly organized by the

from volcanic regions, and tiles of cement richly colored and ornamented with geometric designs.

The Grecian section was originally allotted to the United States of Colombia, which accounts for its position among the Spanish and Latin-American exhibits. The display, although small, is suggestive, containing as it does contributions from the famous Laurium mines near Athens, whose treasures in the ancient days of her naval supremacy went far toward building her fleets and supporting her citizens in luxury. They are now controlled as I have said by a French company, which also exhibit brimstone and sulphur in ores and powders. Elsewhere are magnesite blocks, with emery and lead in crude and manufactured forms. Marbles from the classic isle of Seyros present a business-like aspect, as though advertising themselves, and an altar of Athenian marble is erected by the committee of Olympus, not in honor of the gods but of the Columbian Exposition.

In the western vestibule of the hall are three large gilded cubes, the inscriptions upon which inform us that since 1745, when Russian gold was first mined in commercial quantities, the empire has produced more than 1,800 tons of that metal, Siberia furnishing nearly three-fourths. South of this monument are shown in specimens and photographs the varied mineral resources of a domain which covers one-sixth of the entire land surface of the globe, one side being occupied with a row of cases in which are hundreds of bronze figures symbolic of civilization and barbarism. A shaggy-coated bear rears his unwieldy form beside the figure of a nobleman, and a gaunt wolf crouches near the feet of a richly attired lady. Horses, stags, and dogs, peasants and high officials, princes and Cossacks, with typical representatives of various classes are here reproduced in minia-



CRUCIBLES OF GRAPHITE

Adjacent to the Russian section on the north is the small space in which Japan reveals her mineral wealth, as yet but little developed. The entrance-ways are in rustic form, and within is a tastefully arranged, instructive, and unique exhibit. In the centre are ingeniously constructed models showing the cross sections of mines as worked in ancient and modern times. Front views are also given representing a dark cave which forms the inlet to the old mine, and an ornate pavilion through which one passes into the other. Japanese miners are shown in the narrowest of galleries, lying upon their backs or stomachs, working like slaves, and exposed to all the dangers of caves and explosions, while the tools and apparatus for extracting ore and pumping water are of the most primitive kind. As Japan has recently adopted modern machinery and methods of timbering, the interior view of the mine of to-day presents no remarkable features, the chief interest centring in the skilful workmanship of the model. Close at hand are specimens of coal and copper, silver and gold in the ore and leaf, antimony, commercial clays, variegated marble, graphite, sulphur, native and refined, and table salt in plain and ornamental forms, the first two articles representing an annual yield of about \$10,000,000. Among the minerals displayed in manufactured forms are crucibles made of graphite. There are also photographs of some of the most productive mines,

In the southwestern portion of the hall are the exhibits of Spain and Latin-American countries. The display made by the former consists of massive specimens of lead ore, with primary manufactures of lead, samples of copper, phosphates, salt, slate, marble, and many other minerals. There is also Cuban asphalt, which contains 70 per cent of bitumen, and is said to possess great commercial possibilities. Among the decorative features in the Spanish pavilion is a large array of mining tools, tastefully grouped at various points.

Elsewhere among these groups is sufficient evidence that the republican offspring of Spain are by no means lacking in enterprise. A pyramid in the centre of Brazil's pavilion represents the output in gold of the once famous Minas Geraes, which during the early part of the eighteenth century produced \$700,000,000 of that metal.

Around its base are several varieties of marble and granite, while in trophy and other forms the coal mines of Rio Grande do Sul illustrate the mineral wealth of the country. Mica, quartz, and asbestos are shown in many beautiful shapes, together with lead and copper ores, and the display of gems, though brilliant, attracts less attention than a remarkable stone of elastic qualities, of which there are abundant deposits in the state of Minas Geraes.

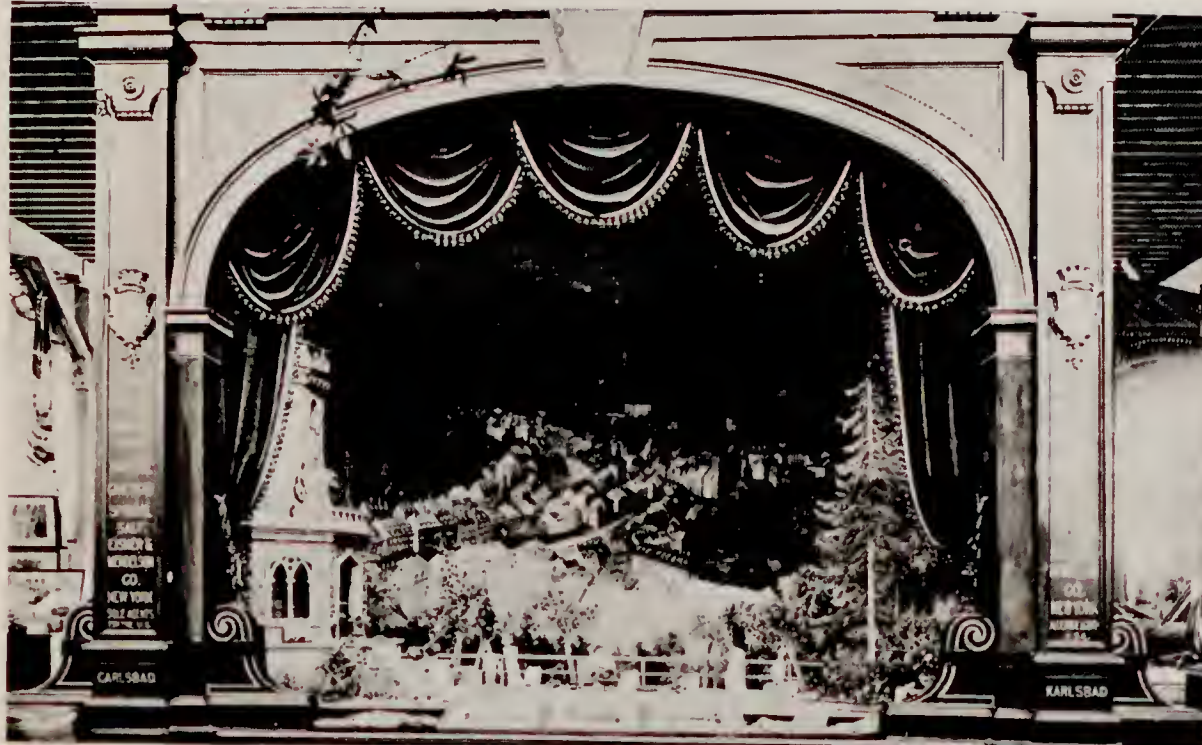
The live-stock and agricultural interests of the Argentine Republic completely overshadow her mining industries, which thus far have not developed into commercial importance. In this department, however, the government bureau of mines and geology has tastefully decorated a large section in blue and white, installing therein specimens of marbles and other building stone, with clays and salts, iron and coal. The geological maps hung upon the walls indicate that the most promising mineral deposits are in the north-western portions of the country, near the headwaters of the Negro and Colorado rivers.

Ecuador and Bolivia have but a miniature display, the former presenting a few specimens of gold among a miscellaneous collection, while the ancient glories of Potosi are but feebly represented in the tiny pavilion of the latter, her mines, which in the sixteenth century produced as much as \$80,000,000 of silver

a year being almost abandoned. The largest mines are now at Huanchaca, and are mainly controlled by Chilean capitalists; but their wealth finds little expression in the hall of Mining. Other exhibits are masses of crude rubber, a portrait of the president, and a large table made by a resident of Cuzco, who informs us that he is no cabinet maker but sends his handiwork, composed of the choicest varieties of native woods, as a contribution to the Fair.

Nitrate of soda forms the text of Chile's exposition. It is displayed in various shapes, a large model of the famous works at Rosario de Huara showing one of the largest establishments for its manufacture in the world. Upon a shaft within this section are statistics as to the growth of this industry from 1830, when only 800 tons of nitrate were exported, until, in 1890, exports had increased to more than 1,000,000 tons. Not only is this a most important source of individual wealth, but the national treasury derives therefrom an annual income of \$20,000,000, or more than one-half of its revenue.

In Mexico nearly 4,000 mines are under regular exploitation, with others worked at intervals, and a vast number of abandoned claims, many of which if reopened would yield excellent returns. While as a rule



AN AUSTRIAN PAVILION



ALABASTER STATUARY



ALABASTER STATUARY



PORTION OF MEXICAN SECTION

processes are somewhat primitive, modern appliances have been largely introduced among the more productive mines, and especially in those which have passed under foreign ownership. One advantage is the cheapness of labor, wages varying, according to the nature of the task, from 50 cents to \$1.25 a day, the latter rate for the barrateros who extract the ore, sometimes receiving in addition a share of what they take out. Other fostering influences are the security for life and property established under the Diaz régime, and the building of railways, affording direct communication with the United States; for until recent years nearly all the heavier machinery was imported by way of Vera Cruz.

The history of mining in Mexico dates almost from the time of the Spanish conquest, and yet her deposits of the precious metals show no signs of exhaustion, the yield of those which have been abandoned being more than compensated by new discoveries. Between 1521 and 1801, a period of 370 years, the total production of silver has been estimated at \$3,570,000,000, and of gold \$277,000,000, while the present yield of both these metals may be stated at somewhat over \$40,000,000 a year. Of coal the annual output is worth about \$4,000,000; of copper, \$2,500,000; and for other minerals, metals, and metalloids, including iron, sulphur, salt, mercury, clay, and ornamental and precious stones, may be added a value of \$25,000,000, thus giving to her mining and mineral products a total valuation of more than \$70,000,000.



ROSE GARNETS

To Mexico was allotted a liberal space in the southwestern section of the hall, her display far surpassing those of Spain and other Spanish-American countries. Here, as in the Manufactures building, an attractive feature is the collection of ornamental stones, and especially of onyx, with a newly discovered variety to which has been given the name of rose garnet. The latter is one of the most remarkable of minerals, combining some of the best qualities of ornamental and building stones, and the only deposit thus far discovered is at Zalostoc Morelos, within 100 miles from Mexico, near a line of railway, and in sufficient quantity to permit systematic development. It is, moreover, a merchantable stone, one which, though harder than granite, can be easily quarried, cut, and polished, and is not affected by the most violent changes of temperature. Technically it is described as a silicate of lime and alumina, and when worked into thin slabs and placed in a strong light, a beautiful color effect is produced, the garnets largely adding to its decorative qualities. Near



CAPE COLONY

an elevated platform, to which a stairway leads from the ground floor. First of all the sand is washed away from the pebbles in a large pan or pulsator, and that which remains is placed in a cylinder, with spiral motion and apertures of various sizes, through which the pebbles are dropped into the sieves beneath. These operations are conducted by stalwart Zulus, attired in full dress Exposition costume—a cap and a pair of short trousers; for other garments they cannot be induced to wear. One of the Zulus stands guard at the gate, armed with a war club with massive ivory head. He is a chieftain of his tribe, a man of gigantic stature, and one of the impi which defeated the British troops in the days of King Cetshwayo.

The pebbles are handed to the sorter, who spreads them upon a table and searches for the diamonds, several valuable stones being taken at times

the eastern entrance-way are pillars, slabs, and ornamental and geometric designs in rose garnet, while the rare beauty of its texture is further illustrated in a delicate plate of the mineral contained in an illuminating apparatus. Elsewhere the exhibits, selected with the utmost care through a commission appointed by the government, are for the most part arranged in cabinet form, many of them contained in handsome bronze show-cases. There is also a group of ore-washing apparatus, and viewed as a collective exposition of mining resources and industries, the entire display is one of which our sister republic has good reason to be proud.

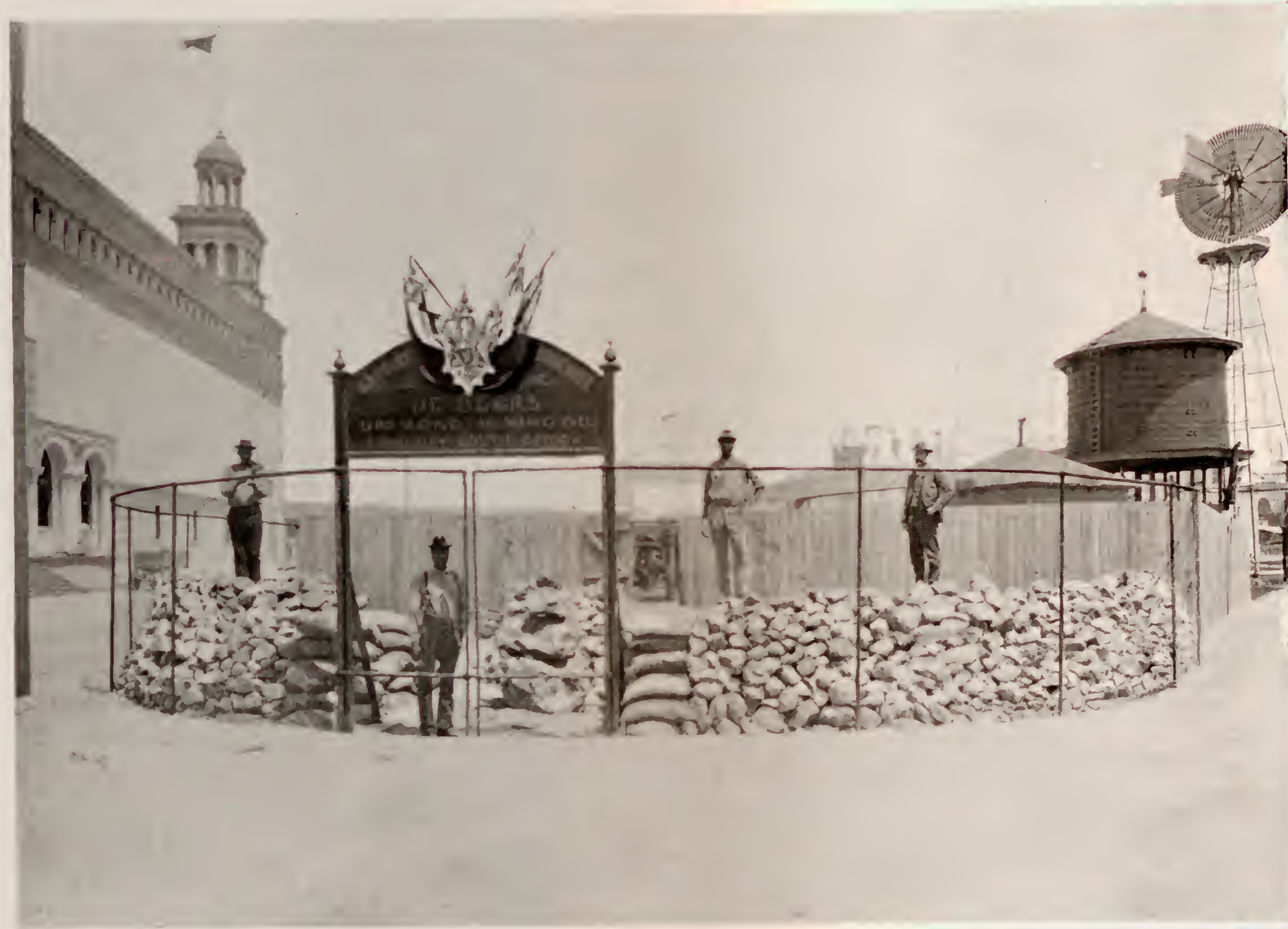
Nowhere in the hall of Mining is there a more attractive spot than the Cape Colony section, south of the Brazilian exhibits; for here of an afternoon, between the hours of two and four, is shown the process of diamond washing from soil imported from the richest deposits of the Kimberley mines. To Americans this should be of special interest, for by the United States are purchased considerably more than one-half of the \$20,000,000 worth of diamonds annually produced by this famous district, almost entirely by a single company, whose rate of production is thus restricted only to maintain the market value of its output.

The section is surrounded by a high partition, with plate-glass windows, within which the earth is scattered as found in the mines; but a better view of the processes of washing and cutting may be obtained from



CAPE COLONY DIAMOND MINES

from a single pan of earth. The rough diamonds are then delivered to manipulators for cutting and polishing, and are thus prepared for market, losing about half their weight through these processes, of which the latter is performed by a revolving plate making 2,000 revolutions to the minute. In a glass case are rough diamonds, valued at \$750,000, including all colors, forms, and degrees of crystallization, from deep brown to purest white, and with many intermediate shades, as blue, green, pink, and orange-yellow. There are also the black diamonds used for cutting, the hardest of all varieties, and such freaks of nature as the twin diamond, the latter exceedingly rare. Other exhibits from southern Africa are specimens of copper ore from Namaqualand; asbestos, whose fibres are of a bluish tint; and a cabinet of minerals collected in the region south of the Zambesi river.



A DIAMOND MINING DISPLAY

In the eastern sections of the hall, and extending into the area occupied by the states, is a large display of mining machinery of many patterns and for many uses. The most extensive exhibits are by Fraser and Chalmers, the Chicago Iron works, and the Gates manufactory, all of Chicago, the specimens from the first of these firms being among the most massive in the building. An imposing structure is the so-called Chilean mill for the crushing of gold and silver ore, its ponderous rollers, as they revolve upon their axis, having also a horizontal rotary motion within the huge metallic die. This is a sample of the score of such mills now in operation in Mexico and the United States, and its companions in this section are several huge quartz mills, a lead furnace, rollers for such fine work as the crushing of diamond bearing earth, and a large assortment of apparatus for the reduction and refining of copper ores. Of the latter mineral, there is a compartment filled with many beautiful specimens, the company also showing samples of a recently discovered alloy, known as ferro-alumina, which is claimed to be the strongest and hardest metallic substance known, and is specially valuable for such castings as the shoes and dies of stamp mills and rock crushers. In the section occupied by the Chicago Iron works are apparatus for crushing quartz, for smelting ores, and for hoisting and pumping, while across the aisle is a crushing plant, installed by the Gates company, including a leviathan rock breaker with a capacity of 150 tons an hour. In this section is also a model in operation, showing the processes of crushing, elevating, screening, and distributing stone used for paving or ballasting.

Elsewhere are various mills for the grinding of rocks, ores, and all other refractory materials, their chief distinction consisting of the various motions with which the rollers work in their dies. Many of the machines are arranged for either wet or dry grinding, some of them stationary, and others portable. There are also

